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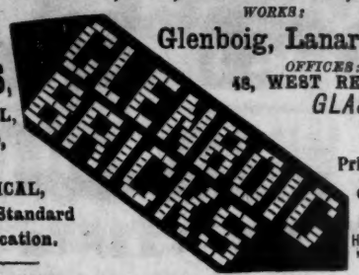

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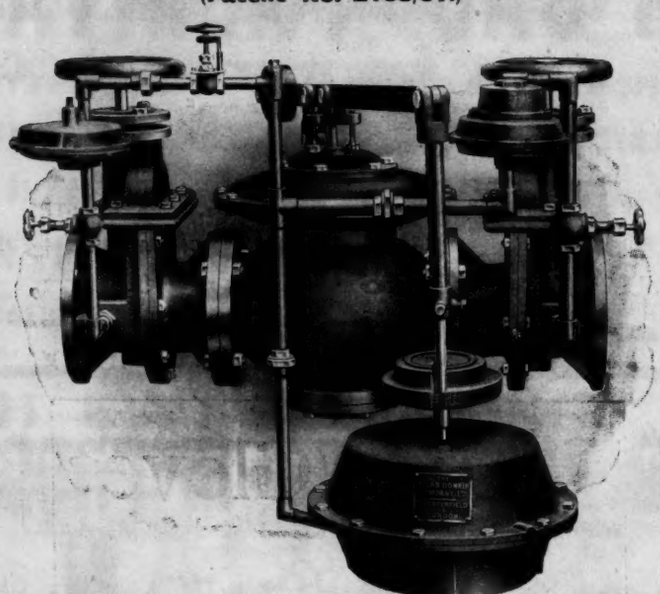

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EDITORIAL NOTES.

The Presidential Address to the Institution.

THERE was not a single line in the Presidential Address of Mr. John Young to the Institution of Gas Engineers on Tuesday last that was void of interest. Even the poetic cullings, on the one hand, claimed our sympathy for the children who have now to retire to bed by daylight, and, on the other, aroused our martial spirit, caused us to straighten our backs, square our shoulders, throw out our chests, and resolve, if we cannot fight, to——well, do our best in providing the maximum possible of benzol, toluol, and other things which King and country want for those who are fighting. For this war, we are not at all grateful to those who forced it—we are everything that is of the contrary. Yet it has provided us all—especially those whose work lies in the gas industry—with new interest and new problems with which to grapple. Even the extraordinary difficulties are cloaked with much interest—interest, compounded with anxiety, as to how best to escape the burdens and the scars inflicted by those difficulties upon the material affairs entrusted to our keeping. The successes of the day, says the President, give encouragement to the hope that to-morrow's difficulties will also be successfully negotiated. That depends upon prevision, and upon the character of the plans put forward to assist in the negotiation. Forces must be united, and united properly. The "successes" of to-day! Market prices for coal are at figures passing understanding, it is difficult to get, freights are high, deliveries inconstant stocks low, contracts are not easily made, and coalowners, or many of them, are looking out for the main chance, and defying the Price of Coal (Limitation) Act; many tar distillers do not, and will not, recognize the increased value of the treated tar that has been used for extracting toluol and benzol from gas; and the sliding-scale as applied to gas companies has not been suspended, so that, with a heavy income-tax, the cash transferred to the pockets of the also heavily burdened shareholders has lost very considerably in weight. Yet we read: "The successes of to-day give encouragement to the hope that to-morrow's difficulties will "also be successfully negotiated!" Whatever the nature of the "successes," there is a heavy discount upon them.

The President's lines have evidently been cast in pleasant places. In his dealings with coal producers, he has not "yet" discovered any ogres. His experience is that they are "upright and honourable gentlemen—very keen sellers, "it is true." "The coal producer is not likely to throw "over the friendly business relations of many years' standing "for a temporary advantage. He knows quite well that we "shall be consumers of coal when the present unnatural "conditions have passed away; and I have faith that the "probity and acumen of the coal producer will induce him "to do his utmost for his old friends." One must speak as one finds; but all do not find alike. We have stored away in memory various occasions when there have been severe tussles with the coalowners over flights in the price of coal. Certain evidence, too, exists as to the Gas Coal Federation doing the contrary of agreeing that they will let their "old friends" off as lightly as possible; and there are departmental reports in which everything was not to the credit of the coalowners. Perhaps the fact that experience has not always been the same as that of the President is because we are not all "John Youngs;" or perhaps the President has been particularly favoured by fortune in always having thrown across his path some of the exceptions to what many gas engineers and managers have found to be the rule.

In another part of the address, the President mentioned a point which has been acknowledged by many scientific investigators, that there is no industry in which coal is used in better manner than in the gas industry, to the end that the potential energy of the coal is largely conserved. Nevertheless, the President had to acknowledge that the gas industry is still a long way from perfection in the conservation of energy. But during the war still more practical results have been achieved; and the nation has not found the gas industry lacking in its efforts to render essential help, without which continued war on the part of this country would have been hopeless. So much so has this been the case that Lord Moulton sent, through the President, a message to the members of the Institution expressing his gratitude for the valuable assistance and loyal co-operation which the department under his control has received from them. Had his Lordship been at the meeting, he would have heard hearty confirmation of his words: "I am satis- "fied that until the cessation of hostilities, I can look to "them for renewed effort in the task which lies before us, "of not only satisfying our own demands, but giving valu- "able assistance to our Allies." The war has been an efficient teacher to the gas industry and to others. It has taught the industry that the production of benzol and toluol is a commercial proposition; it has taught the consumers of gas that there is little virtue in retaining illuminating power as the standard quality for gas; and it has taught the parliamentary authorities that the day has arrived when they can enact that those undertakings which have qualified, or which do qualify (as shown last week), for the change may, on the promoted Bill receiving the Royal Assent, promptly shift the standard of quality from illuminating power to calorific value.

The extraction of benzol and toluol from gas has been raised by experience from a necessary operation to a sound commercial proposition. This, of course, depends on the circumstances of the gas undertakings effecting the extraction—at all events at present, seeing that some of them have not received a penny piece extra for the additional value put into their tar. However, the process of benzol and toluol extraction is intrinsically a sound commercial proposition; and, scrutinizing present position and prospects, the President is fully of opinion that the debenzolizing of gas will pay after the war. Gas is our primary product; its future is assured, by the application of good propaganda work. Coke ranks next; and after the war the commercial position of this product will want safeguarding. Sulphate of ammonia will have strong competitors abroad. The duty of the gas undertakings, subject to their conditions, will be to develop the revenue from tar and its derivatives; and benzol from both gas and tar offers a promising field. This is the line of development which the President, as well as other searchers into prospective conditions, has found. Motor spirit, engine fuel, dyes, and much else will require the products which the very plant yields that has been incorporated in the processes of gas-works for the purpose of high explosives; and still the plant will always be available for the service of the country when high explosives are required. Never was there a development on an old process fraught with so much advantage to the country, which is now seeking to raise its independence to the maximum possible point. There are signs, reproduced in the President's Address, that the Government intend after the war to assist in the maintenance of "pivotal" and new industries—new industries which have lately been established—so far as they are necessary to the full life and vital strength of the nation. The production of benzol and other materials by the gas industry is "necessary to the full life and vital "strength of the nation." Thus there is a clear indication

that the new debenzolizing work presages one important road in the economic development of the industry.

However, the President is persuaded that the recovery of benzol will have a strong bearing on the future production of gas, and that there will in association with it be need for research into the conditions of carbonization. The President supplies good reason for research by a statement which is directly in opposition to a pronouncement recently made by another authority. Mr. Young says that the results of the analyses of tars from gas-works in Yorkshire, Durham, and Northumberland, have led him to the conclusion that "the best benzol and toluol results are obtained in works "where horizontal retorts are in use, in which the coal is "carbonized in thin layers and at a medium temperature." This is a statement distinctly at variance with one made by Mr. Geoffrey Weyman, M.Sc., of the Newcastle and Gateshead Gas Company, in the paper he read before the North of England Gas Managers' Association as lately as May 6 last [see "JOURNAL," May 9, p. 274]. Mr. Weyman said: "The percentage of benzene and toluene in coal gas may in "many cases be almost doubled by paying close attention "to the retort-house. Roughly speaking, high heats and "full retorts are the most favourable conditions. Too low "a heat will produce paraffins, which will spoil such benzol "as is recovered; too high a heat or too much space above "the charge will tend to convert the benzol into naphtha-"lene, owing to the radiant heat from the retort surface, "while the yield of ammonia may be seriously injured." We leave the experts who have investigated this matter to settle the expressed differences of opinion.

There are several other points of interest in the address of the President—all inviting comment; but we must leave them. The points already dealt with show that Mr. Young has put on record an address which will be read far in the future, in view of the indications it presents of the special matters that in this, for the whole world, momentous year of 1916 are engaging the consideration of the professional element in the British gas industry.

The Half-Way House.

ORGANIZATION was a topic that was very present in the minds of the gas men assembled in London last week for the meeting of the Institution; and it had mention several times during the proceedings. It is something gained that there is now a consensus of opinion that there is room for an improvement in the industry's organization by having one coherent body representing all the various interests. When men are so far persuaded, then the next step is to take in hand the legislative work to bring such a body into existence. This is the point at which this much-discussed question has now arrived. It is "no use crying over spilt "milk;" but one cannot help feeling regret that such an organization was not brought into being years ago, when the matter was first broached, for it would have been of inestimable value particularly during the past two years, during the remainder of the war period, and in the time that is to follow. Now the danger that has to be averted is to ensure that a body as useless as the National Gas Committee, and in an exaggerated form, is not brought into existence. The powers that be in this matter are proceeding in methodical manner; but the issue of it all is the important thing. The National Gas Committee (which consists of seven members of the Council of the Institution, seven members of the Council of the Society of British Gas Industries, and seven members of the Executive Committee of the British Commercial Gas Association) were called together to consider the matter on Monday last week; and the outcome of their deliberations was that it was decided to have, towards the end of this month, a conference of the Councils of the Institution and the Society of British Gas Industries, and of the Committees of the British Commercial Gas Association and the Gas Companies' Protection Association. The idea is to see whether at this conference some working arrangement cannot be evolved.

There the matter stands; but it is an open secret that there is some idea of endeavouring to establish, as representative of the whole interests of the industry, a Grand or National Council, composed of the controlling bodies of the various existing organizations. Now whatever the decision come to, there will be loyal assistance in these columns in promoting effective work by the established body, with, of course, the retention always of the right of criticism should the new body not prove a workable machine, or should its schemes and proposals not appear as of good and effective purpose. The National Gas Committee has never been a serviceable piece of mechanism. It might just as well never have had existence for all the good it has done; and if what is now proposed is only going to be that Committee in magnified form, and not thoroughly and systematically organized and operative, then the immediate abandonment of the scheme would be a wise course. We suggest full consideration for the question, Would not the creation of such a body be going only some half way on the road to what is urgently required for the gas-supply industry and all that is cognate to it?

What is wanted is a premier organization which could have in its membership administrators, executive officials of all gas-supply departments, and principals of manufacturing firms, which could incorporate much of the work that is now being done by the other organizations (leaving all scientific and technical matters entirely to the Institution of Gas Engineers), which could initiate and carry out schemes for the promotion of the interests of the industry or for the defence of interests, which could collect and allocate funds, and so forth. The main part of the work of such an organization would be of a political order; but if such a body is not going to be established, and a sort of National Council for the industry is to be created, composed of the controlling Councils or Committees of existing organizations, what is to be the position of that National Council? Would its work be merely advisory, and subject to the confirmation or veto of the organizations represented, which would mean delay and endless discussion? If so, there would be much to be desired in regard to its effectiveness. It would merely be an additional organization, and another member in an already complicated system, bereft of all determining power and prompt action. It would, in the circumstances, accentuate all the drawbacks of the present deficient organization of the industry, which makes the components of that organization individually impotent when dealing with critical and pressing matters of general importance.

Then we fail to see how such a National Gas Council, limited in membership to the Councils and Committees of present organizations, is going to be representative of the whole industry. This is an extremely important matter. Would the creation of such a Council stimulate interest in the general work of the industry? We fear not, and that is what is badly wanted, and *must be* accomplished. During the proceedings at the Institution meeting, Dr. Harold G. Colman and Mr. J. P. Leather spoke of the great need of liberal funds for research, in place of the ridiculous pittances hitherto allowed; and they and others look hopefully to a competent organization relieving the general work of the industry from the disgraceful state of financial starvation in which it has muddled along for years. It was shown, for instance, how research into the question of deterioration of meters, refractory materials, and many other matters will in each direction represent financial economies to the whole industry, and that in these economies there would be large recompense for the contributions of any gas undertaking large or small. But what has been the experience of the past? That it is very difficult indeed to get many Boards of Directors and Gas Committees to subscribe to anything affecting the common affairs of the industry. Why is this? It is because their interest has not been quickened by actual contact with the industry's general work. With the limitations of a National Gas Council if composed as suggested, there will be many Boards of Directors, and many Gas Committees who will never be brought into direct touch with the larger work of the industry, and will continue with their interest unstimulated to subscribing point. We must go the whole way—must periodically bring them together collectively, in order to generate interest, and stir up recognition of the necessity for co-operative work. Then extended support will come, excepting from the parsimonious, and from those who find economy and no shame in declining to subscribe to a common cause from which all derive advantage. Proper representation, proper financing, and, in fact, proper support for all objects bearing upon the industry's progress will never be secured without a premier organization open to the membership of all who are eligible; and all who should be eligible are those holding responsible positions in the industry. Perhaps the construction of a "half-"way house" would result in time in the foundation of an effective premier organization; but it may be confessed that we should have much preferred to see a statesmanlike and Imperial attempt made to deal at once with the question of such a complete organization.

Destructive Influences on Meters.

A PIECE of practical research, which is likely to result in large economy, is that on the life of gas-meters which a Joint Committee of the Institution of Gas Engineers and of the Society of British Gas Industries have in hand, and for which they have been fortunate in securing the able services of Dr. R. Lessing. His preliminary report is a very valuable one; and, in every line of it, there are the indications of the researcher who is out to get to the truth of the matter (we might almost say the "mystery") which he has been invited to explore. And this particular matter happens to be one of immense financial importance to all gas undertakings, because when meters begin to deteriorate more rapidly than they did before, and parts require repairing or renewing more frequently, this means an increase of expense for materials and labour, and a greater reserve of meters in store, as well as consumers being put to some additional inconvenience by the shorter continuous working life of their meters.

Some say that the accelerated rate of depreciation is due to the materials of which the meters are constructed; others allege that the troubles are chargeable to the changes that have been effected in the manufacturing processes on gas-works. The provisional conclusions to which Dr. Lessing has arrived point to his opinion that those who hold the latter view are correct. We have qualified the word "con-" clusions" with the term "provisional," because all through the report it is obvious that the investigator is very solicitous (while he believes he is on the right track of the destructive influences) that final judgment shall be suspended until further research confirms or negatives the conclusions so far reached, and until it is ascertained whether or not there are any other contributory causes. Of course, meters have now to do more work than formerly, and this greater work falls heavier on the small domestic sizes than on the larger ones, and those meters, too, are the ones of lightest construction. If the gas is the root of the mischief, then, the larger the quantity passed through the meters in a given time, the quicker will be the rate of destruction. And Dr. Lessing is fairly well satisfied that changes in the processes of gas manufacture have yielded and sent forward with the gas certain impurities—particularly cyanogen, sulphur compounds, and ammonia—which are unfriendly to the structural metal parts and the leather diaphragms, through being deposited with the liquids inside the meter. Mr. Thomas Glover (Norwich) also mentions the corrosive action of the increased free oxygen found in the higher productions of gas per ton of coal carbonized—the productions of which gas managers are so proud, and some of which tell a fearful tale on analysis of increased percentages of inert gases. However, the impurities which Dr. Lessing refers to suggest an insufficiency in the scrubbing and purifying arrangements on gas-works, and of the meters acting, as time progresses, as subsidiary scrubbing arrangements, and so involuntarily assisting in bringing about their own destruction, through extracting from the gas the deteriorating substances. Even in present-day practices, the attempt to escape from one trouble contributes to another. The use of petroleum hydrocarbons and tar distillates of comparatively high boiling point for the purpose of naphthalene removal takes up the oil dressing from meter diaphragms, and so exposes the leather to the chemical action of corrosive gases or liquids. Therefore, Dr. Lessing warns, the recent proposals for the spraying into gas of such high boiling distillates as ordinary kerosene or lamp oil must be regarded with some concern.

That Dr. Lessing is on the right track, so far as present information goes, hardly admits of question, in view of the amount of tin and iron and leather found on analysis in the liquid deposit in the casings of the meters. But he wants to confirm his findings in every possible way before speaking positively. If the confirmation is obtained, then it will be necessary to carry investigation into the gas-manufacturing region, in order to see whether or not the gas maker cannot alter his practices so as to avoid the destructive influences. There is the alternative—investigation to ascertain whether meters cannot be constructed to withstand the destructive substances. But this would not help in regard to existing meters, the destruction among which constitutes in the aggregate an expensive matter for the industry. If additional gas-cleansing plant is what is required, then that is the way to financial saving. Gas engineers are already anxious to begin to reap result from this investigation; and it is one upon which they say there should be no stint of money—so far as money is requisite to hurry it forward. But no money can possibly remove the abnormal conditions of the present in connection with gas manufacture, which conditions rather impede the progress of the investigation.

Injector-Ventilating Gas Appliances—Some Further Investigation Desirable.

THERE are points about the third report of the Joint Committee on Ventilation Research of the Institution of Gas Engineers and the University of Leeds that are not quite so satisfactory as could have been desired; and simply because the Committee have not gone far enough nor done enough before issuing the report. There is an old and worthy adage which bids us hear both sides before passing judgment; but the Committee have passed judgment, on the strength of certain experiments without thoroughly investigating the prior work of others, and admittedly on experimental means which are not precisely on all-fours with actual and practical constructional design—in fact, in comparison are crude. We are not going to declare that the Committee are wrong in all their conclusions; and we are certainly not going to say they are right under any and every circumstance. All we are prepared to do is to ask others, as we intend to do ourselves, to suspend judgment until a thorough investigation has been made of prior work, and of actual constructions, to ascertain whether, given correct design and application, there is anything in the injector-ventilating principle, in respect at any rate of gas-fires. All the present report, for the time being, can be accepted as showing ground for is, in justice to makers of certain gas appliances, an investigation into their claims with their own appliances.

The Committee themselves seem to indicate an inconclusiveness about their investigation, and yet they show a sufficient confidence in its results to express a positive opinion, and to condemn the injector-ventilating principle as worthless. At the forefront of their report, they write: "A "question which suggests itself at once is as to how far condi-" tions in existing installations resemble those of our experi-" ments. An adequate answer will require the systematic " testing of a number of existing installations, but further " laboratory investigation seemed advisable in some directions " before proceeding to that very necessary part of our work." While the Committee mention that an "adequate answer" demands certain further "necessary" research, they also emphatically remark: "We have not found in any of our tests " that the injector principle as applied by leading products " of combustion at nearly normal pressure along a narrow " tube, with a view to their inducing a flow along an en-" circling or apposed air-duct, and so increasing the total " volume moved, has any validity." The Committee, it will be observed, confine this conclusion, though positively expressed, to the results of their own tests so far as they have been carried: "We have not found *in any of our tests*" that the injector principle has any validity. There are those who accept the work of the Committee; there are others who prefer to defer acceptance until the tests have been otherwise confirmed. Mr. Jacques Abady is of opinion that the work of the Committee has done "a great deal to explode " the old fallacy as to an inner tube exercising any injector " action;" while, on the other hand, Mr. John F. Simmance could apparently, if he only chose, be very critical as to the methods adopted by the Committee in their investigations. For instance, he points out that from an uninsulated iron tube such as the investigators used as a flue, there must be considerable escape of heat.

In other respects, the methods employed in the experiments do not appeal to us as being all they should have been for such a categorical conclusion as the Committee advance. For example, in figs. 10 and 11, there is shown a tube 3 inches in diameter and 2 feet long. At the foot of the tube, a ring-burner was put—gas being burned at the rate of 12½ feet per hour. A certain result in the volume of air passed up the tube (without injector-tube) is shown in Table II. Then an injector-tube was put inside, partly choking the uptake tube and reducing its carrying capacity—no provision being made in any way to give space for an additional flow, or to compensate for the room taken up by the injector-tube. The same quantity of gas was burned; the same quantity of products of combustion had therefore to be removed. Under the conditions of the test, the volume passing up the tube was less than when the tube

was not partially choked by the injector-tube, without any compensations being made, and without any proportioning of the tube to the extra work expected to be done by it. Subsequent experiments on the volume of air moved by different consumptions of gas up flues of various sizes, show that there should be proper proportioning of the tubes to the work done. We are not defending the injector principle, but are inquiring whether the "validity" of the tests themselves is not open to question. Then in the tests with the gas-fire, in which a partitioned flue (fig. 8) was used—one division for air, the other for the products of combustion. The investigators state that their intention in this device was "to reproduce, *as nearly as possible*, a method of applying the injector principle to gas-fires which has been adopted in practice." "As nearly as possible" ought not to be good enough for scientific work and accurate conclusions; it certainly ought not alone to be sufficient for the condemnation of a commercial appliance claiming specific advantage. The experimental divisioned device appears to have been employed as an attachment to an ordinary gas-fire (with ordinary flue-vent), and, so far as we are concerned, of unknown construction. Now, does this device—a device foreign to the design of the gas-fire—represent precisely the same thing as a gas-fire specially constructed with the injector ventilating arrangement as an integral part? If not, then the tests should be repeated with an actual example of the injector-ventilating gas-fire, and with one as nearly similar as can be obtained without the injector-ventilating principle embodied in it.

There has been little scientific work done in the testing of the air-removing capacity of modern ventilating gas-lamps with or without injector-flue arrangement. But there has been a large amount of investigation with gas-fires constructed on the injector-ventilating principle; and we want to know why it is the tests, on the small laboratory scale at Leeds, are diametrically opposed to published data with these gas-fires? We should like to know, too, whether the Ventilating Research Committee impute error to, or impeach the integrity of, those who have made prior research into the question, and have published the results. At the British Association meeting in 1915, Mr. H. James Yates read a paper, in which certain results were given from investigations carried out by Mr. Arthur Forshaw M.Sc., and Mr. S. C. Farrar, B.Sc. Those results showed that, with the new injector-ventilating fire, 11,800 cubic feet of air were removed per hour from the room in which the tests were made; and with four ordinary gas-fires the volumes of air removed were 4500, 4850, 5600, and 5000 cubic feet per hour. Therefore the injector-ventilating fire in that test shows "an increase to over double the air removed by the nearest ordinary gas-fire." Now, was Mr. Yates hoodwinking the British Association, or are Mr. Forshaw and Mr. Farrar incompetent, careless, or what? If they cannot be charged with one or the other, then their tests should be capable of repetition. But the Joint Committee now tell us, on the strength of their tests, that the claim as to the increased volume of air moved has no validity. There are contradictory statements and data here which cannot be reconciled; and it is the business of those concerned to see that the differences are satisfactorily cleared up. Perhaps the investigators are stumbling over fine academic distinctions as to the meaning of the word "injector." So far as the "injector ventilating" fire is concerned, the word "injector" might just as well be relinquished. Remember the ventilating fire in question must be taken as a complete design and structure. What is claimed for it is that, with the central plate in the specially devised and proportioned flue, the momentum of the products of combustion is increased, and that this has the effect of accelerating the indrawing of air from the room, and its discharge into the chimney flue. Certainly when we were present at tests made with the actual fires, there appeared to be a distinct difference in the velocity of the discharge from the ventilating fire and in that from one of another design, equal gas consumption, and good flue vent; and before then and onwards up to the time of the British Association paper already referred to, the laboratory test-records with actual fires all tended to confirm this observation. More than that we cannot say.

It is evident from this, after all the research work that has been done in this connection, that the initial mistake of the Joint Committee has been not to have invited the co-operation of the manufacturers, knowing how their interests were affected. As Mr. H. M. Thornton, the Chairman of the Council of the Society of British Gas Industries, impartially put it in the discussion, there must be a great deal of valuable information in the hands of makers, as the result of their research work; and really it is difficult to think that those who introduced the injector-ventilating gas-fire should have placed themselves in such an extraordinary position as to publish the statements that they have done, if they were incapable of substantiation. But what the Committee say in the report is tantamount to an assertion that the statements are incapable of substantiation. Meantime, outsiders are left in a quandary.

Payment for Public Lighting during Military Suspension.

Judgment has been given by the Court of Appeal in the Leiston-cum-Sizewell public lighting case; and the Urban District Council, who were the appellants, have lost, and lost heavily. They have now not only to pay the contract price for the street-lamps during the military suppression of the public lighting, but they have to defray the costs of fighting the matter in the Court below and in the Appeal Court. It has been an expensive business for them to try to save the cost of 101 lamps at £1 7s. 6d. each per annum, with four all-night lamps at £3 7s. 6d. each. What they have secured for all the expenditure on litigation are four ponderous judgments, which would have done credit to a larger and more permanent issue—one by Mr. Justice Low in the Court below, and one apiece from the Lord Chief Justice, Lord Justice Warrington, and Mr. Justice Scrutton; and they have established a principle (adverse to themselves) which no other local authority has deemed it necessary to trouble about, unless, of course, Leiston is merely a test case, and there is more behind it than meets the eye. However, the decision of Mr. Justice Low is confirmed. The facts are simple and plain. The Gas Company and the Council had a five years' contract running, under which, for an inclusive price, lamp columns, lanterns, mantles, lighting and extinguishing, cleaning, maintenance, and gas were to be supplied at an inclusive sum per lamp per annum. Then came the intervention by the military authorities; and public lighting was prohibited, from which point the Council did not want to pay, although the Gas Company were willing to make an allowance for the gas unconsumed.

Contentions and Decisions.

The District Council contended that the contract must be regarded as one made for the public lighting of the district, that the contract was impossible of fulfilment, and that the action of the military authorities discharged them from the liability to pay—in short, that the foundation of the contract was destroyed. Four learned Judges decline to support these contentions. The Lord Chief Justice held that, though part of the performance of the contract had become unlawful, another part of the contract, which could not be regarded as a trivial part, was lawful, and could be performed. Under the agreement, the payment being inclusive for all the services, his Lordship also held that the consideration could not be apportioned. The views of their Lordships all converge to the same conclusion. We do not suppose many other local authorities require legal leading on a matter which, under the circumstances, should be subject to amicable arrangement. But those who do want guidance where the contract is on similar lines to this one have it now, and with the seal of the Court of Appeal upon it. But there are other public lighting contracts under different conditions; and at times, a friendly agreement is the correct and sensible course to take. The Leiston District Council have speculated, and lost heavily.

Leakage from Water-Mains.—Summarizing an article that recently appeared in the "Journal of the New England Water-Works Association," our contemporary "Engineering" says that the author, Mr. A. H. Smith, observes that the leakage from water-mains is usually surprisingly high. The general opinion of water-works men is, he says, that from 30 to 40 per cent. of the total supply is lost by leakage. The leaks may be in the underground mains, in broken or abandoned service pipes, or in faulty domestic fittings. In a test of mains at Medway, Mass., having lead joints and working under an 80 feet head, the underground leakage amounted to 20,800 gallons (U.S.) in twenty-four hours, which was equivalent to 1·58 gallons per lineal foot of the joint. As a remedy, Mr. Smith expresses the opinion that either some better material than lead must be found or more care must be taken in making the joints. He considers that a loss not exceeding 1 gallon per day per foot of joint under 100 lbs. pressure may be regarded as satisfactory.

THE INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE FIFTY-THIRD ANNUAL MEETING,

HELD AT

THE INSTITUTION OF CIVIL ENGINEERS, LONDON,

JUNE 6, 1916.

President: Mr. JOHN YOUNG,

Engineer and Manager of the Hull Station of the British Gaslight Company, Limited.

REVIEW OF THE PROCEEDINGS.

[For full Report see p. 565.]

It seemed almost like old times—in one respect. That is to say, the number of members attending the annual meeting of the Institution last Tuesday was much on the same level as one was wont to see on the opening morning of the annual meeting in normal times. We are getting accustomed to things abnormal. But some abnormal things are distasteful; and it is distasteful not to see a good representative muster at an annual meeting of the Institution. We were saved that on Tuesday. But *tempora mutantur, nos et mutamur in illis.* Every year sees some fresh permanent changes in the personal complexion of the meeting. Every year there are well-known faces and figures absent, never to return. Every year are seen men filling the places of those who once were active spirits in the Institution, whose voices, which were heard with pleasure, will never be heard again. Men may come, and men may go, but the work of the gas industry must go on, and with even more strenuous application, for work increases, demands expand, with conditions in some respects more irksome, in others easier. These reflections pursue one another as, in early attendance at the Institution of Civil Engineers, one waits for the proceedings to commence.

Insufficient Time for Conference.

Reflection and observation are interrupted by a neighbour suggesting that it is a pity that the meeting had not been extended to two days, so as to have given more time for private conference. The speaker admitted that the claims of the works press more heavily in these times, and demand close personal attention. But "abnormal conditions" are again dragged up, and to good purpose in the making of a point. "When conditions are so abnormal as now," he remarked in effect, "there is much more to confer about—more even than in times when the affairs of the industry are pursuing an even course. Therefore, all the more reason for not rushing things through with such speed that members disperse, and are homeward bound, before there has been an opportunity of seeing more than two or three of several men with whom one wants to have a little conversation." Location is a factor in the argument. But omitting that, there are of course arguments both ways; and their strength has much of an equality, so there is little use discussing the matter. There can be agreement with those who regard the claim of duty as so strong that they prefer to be absent from their works as short a time as possible, and there can be perfect accord with those who feel that their duty is, when opportunity occurs, to secure by conference as much information as possible that will be useful to them and to their undertakings. The member for Colchester—Mr. W. W. Townsend—also made the point when matters raised by the annual report of the Council were under discussion.

A Full Theatre, and the Opening.

The proceedings did not start quite punctually; but seeing there had been a meeting of the Benevolent Fund Committee, this was pardonable. Just before 10.30 the tardy incoming of members was accelerated; and soon the large hall was well-filled. There were two representatives in khaki. One was Second-Lieutenant H. L. Strange, R.E., the Engineer and General Manager of the Honolulu Gas Company, Limited, who has come over here (as we recently said) in the cause of "justice and humanity." Incidentally, we heard at the President's luncheon, he brought greetings from the American Gas Institute. There was also Lieut. Lees, son of Mr. Herbert Lees, of Hexham. The big audience that faced the President, and acclaimed him, as he took the chair, was a tribute to the popularity of Mr. John Young; for his friends extend to wherever the British gas industry exists. It was also a testimony to the desire for conference, and to learn first hand how things are going in other quarters. Accompanying the President were the incoming President (Mr. A. E. Broadberry); the new Senior Vice-President (Mr. Samuel Glover); and the new Junior Vice-President (Mr. Thomas Berridge). To the immediate left and right were the Hon. Secretary (Mr. W. E. Price) and the Secretary (Mr. Walter T. Dunn)—both energetic in assisting in the conduct of the affairs of the meeting. Also at the head table were members of the Council: Mr. W. Doig Gibb, Mr. Hubert Pooley, Mr. John Bond, Mr. W. R. Herring, Mr. S. Y. Shoubridge, Mr. W. Whatmough, Mr. J. W. Auchterlonie, Mr. W. W. Woodward, Mr. J. H. Brearley, Mr. W. B. Farquhar, Mr. E. A. Harman, and Mr. W. J. Rendell Baker.

The Late Sir Corbet Woodall.

There was only a little formal business to be transacted; and then, fittingly before proceeding further, there came the expected—a resolution deploring the death of Sir Corbet Woodall, expressing sympathy with Lady Woodall and the family, recording the high personal qualities and professional attainments of Sir Corbet, and appreciation for all that he did for, and was to, the gas industry. The resolution was moved by the President, who left for his address, when alluding to the other losses sustained by the profession, his own personal appreciation, couched in phrase terse and sincere. "Sir Corbet Woodall stood for all that was highest and best and noblest." "Our profession was honoured by his association with it." "Those who knew him best admired him most." "I mourn the loss of a very true friend." These are samples of gems of the first water. Sir Corbet's fame had travelled far; respect and regard for him were not confined to this country. It was the President's gratification to read from the President of the Société Technique a graceful expression of deep sympathy, and of acknowledgment of great qualities. Appropriately, the President-Elect, who had been closely identified with Sir Corbet in the work at Tottenham, seconded the resolu-

tion the President had moved. Mr. Broadberry spoke with the feeling inspired by intimate association; and there was endorsement of his words that "the good that Sir Corbet did will be remembered by us for years." Standing in silence, the members gave ratification to both resolution and the words that had been uttered.

The President's Address—Benzol and the Future.

We all know the President. In the British gas profession, there is only one John Young. He is a feature in its *personnel;* for he is incomparable in the degree of the characteristics with which he has been endowed. Breezy and genial one minute, he can be grave and thoughful the next, and always loyal to the interests with which he is entrusted. He has been very loyal to the interests of the Institution and the gas industry generally in manner that the office of President permits. When he rose to deliver his address, there was repetition of the former hearty reception. The address was published *in extenso* in our last issue, and comment is made upon it in earlier columns. Therefore, suffice it to say here that the address was a production composed of a thoughtful survey of current considerations, and an attempt to focus the bearings of salient present conditions—such as coal and gas debenzolizing—upon the conditions of the future; as well as an appeal to the men of the industry at home to do their utmost, while blood is being shed and treasure expended elsewhere, in providing all those requisites that position and opportunity enable them to do. When Mr. Thomas Glover, of Norwich, in proposing a vote of thanks to the President, described the address, as a "stirring" one, he used an apposite expression, and when he voiced the hope that the deliverance had stirred the patriotism of the hearers to greater heat, and that this would be shown by a larger extraction of benzol from gas, there was emphatic indication that this would be the case. In his address, the President had asked the question, Will the debenzolizing of gas pay after the war is over? And his reply was: "I most certainly think it will." He had also referred to what Mr. Milton Sharp said at a recent meeting of the Bradford Dyers' Association, and to what that gentleman had observed as to the plants that are now employed in the production of substances required for explosives being the plants that will be needed for the production of dye-stuffs after the war. Suitably, therefore, Mr. Charles Wood, of Bradford, was the seconder of the vote of thanks; and we learned that it is his opinion that the President is right in every word he uttered as to the continuation of gas debenzolizing after the war. The processes now at work will be required as much after the war as at the present time. That is Mr. Wood's view; and anyone who considers the ambition to make this country more self-reliant, not only for the materials for explosives, but in respect of motor fuel and dyes, cannot do aught else than endorse this view.

Report and Accounts.

There was a good deal of talk round about the report and accounts, the adoption of which was moved by the President, and seconded by Mr. J. P. Leather, with brevity and to the point. The latter considered the report showed that the Council were not dead, though a good many subjects had had to be postponed. But there was some impatience over the diffuseness of one subsequent speaker, in view of the time limitation and the length of the programme. Exceeding great pleasure was found by Mr. C. E. Jones in the honours that have been done the gas industry by the elevation to the Privy Council of Sir Daniel F. Goddard, M.P., and by the election of Mr. H. E. Jones as a Vice-President of the Institution of Civil Engineers. He also poured scorn on the circulars issued by Government Departments which cause one to doubt if they altogether know the real effects of their suggestions. We heard, too, from Mr. Jones how he nearly shouted himself hoarse as the little "Wandle"—one of the Wandsworth Company's colliers—and her gallant crew recently passed up the Thames scarred but victorious from her contest with a German murder-commissioned submarine. The large outlook which Mr. S. B. Langlands takes upon lighting matters leads him to think that the Institution should enter upon research into monazite sands. In fact, he does not see why the gas industry should not try to get the monazite sand fields of India into its own hands. Of course, the suggestion comes too late. Besides, the Institution finds it has to cut its garments according to its cloth; and it must not think of additional research until there is more money available for the purpose, let alone contemplate becoming the owners of monazite sand fields in India. There was a pause, and Mr. George Helps rose, and made the momentous announcement that he had been waiting to see how many were going to get up, but the members had left it to him again. There was laughter; and Mr. Helps intimated that he had not very much to say that morning. Whereupon an unkind member interjected a "Hear, hear;" and there was more ungenerous laughter. But the question that Mr. Helps had to ask (as will be seen by a succeeding paragraph) referred to the important subject of organization. On the same subject Mr. H. E. Jones had some remarks to make; and he also made an interesting statement on the fitting of the "Wandle" and the Wandsworth Company's other colliers with a gun apiece. The advantage has been witnessed. It was suggested by Mr. W. W. Townsend that the time of the members could on this occasion have been better occupied in discussing the question of the oil-washing of gas, than in considering just now such questions as refractory materials and the life of gas-meters. The report was adopted.

Alien Enemy Members.

Attention was directed by Mr. J. W. Buckley to the names of five members of alien enemy birth on the roll of the Institution; and he suggested that the Council should consider the question of their removal.

Organization of the Gas Industry.

There was quite a lot heard, at various times during the meeting, on the topic of the organization of the gas industry. It is clear that it bulks large with interest, and that the interest is still growing in all quarters. It had a whole section to itself in the President's address, which made up for the microscopical paragraph at the very end of the report of the Council. The President in his address referred to the existence of a National Gas Committee, which, if ever a properly formed organism, has never, as far as we are aware, been applied to any useful purpose. It seems that this curious creation, which existed more in name than in actuality and with activity, has a septuary composition—seven members being drawn from the Institution, seven from the Society of British Gas Industries, and seven from the British Commercial Gas Association. Mr. George Helps elicited an explanation from the President, from which it seems that the best piece (it is not certain whether it is the first piece) of work the Committee of twenty-one have ever been guilty of doing has been to be called together to see how it could improve upon its inanimate self with the view to meeting a desire for better organization in the gas industry. According to the President's statement, the Committee met the previous day. It was good hearing that the one thing uppermost in the minds of the "National" Committee was a desire to further the best interests of the industry. That is decidedly hopeful. But the upshot of the meeting was that it was arranged to hold (before the end of the month) a conference of the Council of the Institution, the General Committee of the British Commercial Gas Association, the Council of the Society of British Gas Industries, and the Committee of the Gas Companies' Protection Association to see whether some good working arrangement could not be evolved, which would represent every phase of the gas industry. Some concern was shown by Mr. H. E. Jones that in this matter of organization (he would persist in calling it "affiliation"), the Institution should preserve its scientific character. The functions of such an organization in his opinion are distinct, and ought to be kept separate from other bodies, though he appeared to have an open mind on the question as to whether it would not be a good thing for the other organizations of the industry to become welded together. But he suggested that, if the Institution became affiliated to any body at all it should be to the "mother" of all professional organizations—the Institution of Civil Engineers. It seemed to Mr. F. W. Cross that the proposed Council for the industry does not aim high enough, and that it should include in its composition administrations of gas undertakings, and not executive officers only. The "national" questions of the industry require to be dealt with by a fully representative body. Mr. F. W. Goodenough pointed out that the organization would include a number of chairmen of gas committees and gas companies. Most of the foregoing points arose upon

the motion for the adoption of the annual report; and later, in presenting the report of the Refractory Materials Committee, Dr. Colman showed how impossible it is to carry on research effectively without adequate finance. Funds and organization are co-related questions.

Refractory Materials Committee.

The absence of members of the Refractory Materials Committee on active service ought not to be a bar to the prosecution of research; and it is a pleasure to see that, during the absence of Major Bywater, Mr. J. P. Leather has undertaken the duties of Acting Hon. Secretary. The Committee have done such excellent work, and promised to improve upon and to carry it further, that the long continued breach in the investigation is a little unsatisfactory, and has given rise to comment, especially at the recent meeting of the Manchester Institution. There was promise in last year's report of the Committee; there is promise along the same lines in this year's report. However, hopes of something additional and material being forthcoming by the end of next year will be engendered by two things in the report of the Committee, which was next submitted to the meeting. It is stated that "steps are being taken to ensure more active prosecution of research on important questions connected with the work of the Committee." That is so far good. Then there has been a grant of £130 for the Committee's work for the current year by the Advisory Committee of the Privy Council for Scientific and Industrial Research—this contribution being supplementary to the grants of £50 each by the Institution themselves and the Society of British Gas Industries. While not believing in waste, the refractory materials question is so large, and of such immense importance to so many industries, that the principle of financing the research by a spoonful at a time is not altogether encouraging, and certainly it is an effectual limitation. The time devoted to the work, and the progress made, may both be curtailed by the money available. However, in the report itself the Committee do not complain, but, on the contrary, seem to feel in rather an opulent position. This may be comparatively with a past state. However, notwithstanding that work has not advanced far on the subjects mentioned in last year's report—the difference in size of bricks when cold and when at high temperature, also the behaviour of cement material employed in retort-settings—the advance by the Privy Council Advisory Committee has enabled the Committee to make a commencement with investigations on the (*a*) relative effect of an oxidizing and a reducing atmosphere on the refractoriness of fire-resisting goods, (*b*) the influence of fine dust carried into the settings on the refractoriness and life of the materials employed, (*c*) the effect of an admixture of highly silicious rock—such as ganister—on the working qualities of fire-clay goods, and (*d*) the effect of firing temperature on the subsequent refractory qualities of the goods." Work has been going on which has been "useful;" but now for his experiments Dr. Mellor has been authorized to have some bricks made "of known materials, under known conditions, from different types of fire-clay, and with varying proportions and varying sizes of grog." Tests with these should result in information valuable alike to the manufacturer and user. Dr. Mellor has rendered inestimable services to the gas industry in connection with the subject of refractory materials; and so have Alderman Elliott and the Education Committee who control the County Pottery Laboratory at Stoke-on-Trent.

Research and Funds.

There has been some dissatisfaction in regard to the specifications of the Committee; and Dr. Harold G. Colman made acknowledgment of this when introducing the report of the Committee. But he also claimed that in other cases, material made to the specifications has given satisfaction. At first it was not considered desirable to specify the minimum or maximum conditions of material; but in good time there is to be a stiffening-up of the specifications. This, however, must be preceded by a considerable amount of research; and this is a point upon which Dr. Colman had justifiably a good deal to say—in fact, with the funds placed at their disposal the Committee could not possibly have done all they have succeeded in accomplishing, in the investigation of such complex problems as those inherent in refractory materials, had it not been for Dr. Mellor (who has carried out work at a cost which would not cover expenses) and the County Pottery Laboratory at Stoke. The requisite apparatus for the work—apparatus running at very high temperatures—would have cost much money. Silica or silicious material is a matter that requires much further investigation; and Dr. Colman, in this connection, bore testimony to the valuable paper that Mr. John West read recently before the Manchester Institution. If from the research better quality goods are obtained, practically every gas undertaking would save more in lengthened life of the materials than is now spent by the Institution upon the investigation. This was a point—and a good one too—made by Mr. J. P. Leather when seconding the adoption of the report. Mr. H. Kendrick is one of those who so far has found but little, if any, benefit from the work of the Committee. There is, too, the utter impossibility of every gas undertaking going to the expense of equipping itself with the plant necessary for ascertaining whether or not specifications have been fulfilled; and it is Mr. Kendrick's view that it is an aspersion on firms of good standing to test the quality of the goods they supply. But this is what is done, and is expected will be done, in most business transactions. Dr. Colman got one back on Mr. Kendrick when he pointed out that local authorities even test the gas supplied by gas companies.

Loyalty and High Explosives.

A message was sent to His Majesty the King, expressing the loyalty of the members, and assuring him that they would efficiently continue the work carried on by them in connection with the manufacture of high explosives. An appreciative reply has since been received.

Injector-Ventilating Gas-Burners and Gas-Fires.

There will be—we might say there are—mixed feelings in quarters where gas-burners and gas-fires are made over the third report of the Joint Ventilation Research Committees of the Institution and the University of Leeds; for that report (which was next introduced by Professor Arthur Smithells, the Chairman, and its adoption moved by Professor John W. Cobb) declares a negative result from experiments for the application of the much-acclaimed injector-ventilating principle as compared with simple and properly proportioned provision for ventilation. But in considering the results of the report, the point made almost at the beginning should not be overlooked: "A question which suggests itself at once is how far conditions in existing installations resemble those of our experiments. An adequate answer will require the systematic testing of a number of existing installations; but further laboratory investigation seemed advisable in some directions before proceeding to that *very necessary* part of our work." So that it may be taken that the report, so far as it refers to auxiliary ventilating devices, is subject to confirmation or otherwise by tests carried out with injector ventilating lamps and fires fixed and operating under ordinary conditions. It may be assumed that, in the preparation of the report, Mr. William Harrison (Research Chemist) has been assisted by Professor Cobb; anyway, it has the endorsement of the Committee whose names appear at the head of the report. Mr. Harrison gave a short epitome of the report, which is divided into four parts, treating of: (1) The conditions which contribute to the setting-up of down-draught; (2) results of experiments with a ventilating burner with injector; (3) gas-fires and the injector principle; and (4) the relation of gas consumption to volumes of air moved up flues of various sizes.

Down-Draughts.

The conditions promoting down-draught are somewhat obscure and complex; but they are frequently (though not universally) due to the relationship of the affected chimney to some external object, which acts as a check to, or alters the course of, the current of the wind. Several chimneys when built in close proximity to each other may have an influence; so, too, may the relation of the roof to a chimney, and the angle of inclination of the adjacent part of the roof. In the experiments, a current of air of known velocity representing the wind was therefore sent across the top of a tube representing a chimney; and planes were set round about the tube in various positions to simulate roofs and walls. Down-draughts were diminished or increased as the angles of the planes were altered; but when the top of the flue was gradually raised above the

level of the tops of the planes, the up-draught increased until it became the same as when no planes were used. Care should be taken in fixing flue-pipes, and especially geyser flue-pipes. The reporters remark: "In practice, it is a common thing to see a flue-pipe from a gas-fire or gas-stove fixed up the side of a house without extending to the lower level of the roof. Obviously, when the wind blows against that side of the house where the flue is placed, strong down-draughts will be produced from an increase in pressure around the top of the flue; and this cannot be prevented by any form of cap placed on the flue. The only cure is to raise the flue considerably above the level of the roof." But it is also admitted that "many down-draughts are preventible by any construction of chimney cap in which currents are deflected in a manner consistent with the indications of the experiments described." Of course, there are other factors that may contribute to down-draught—for example, any suctional effect exercised on a door or window [let us supplement the report by suggesting as by an electric-fan] would, by lowering the pressure at the bottom of any flue inside the room, tend to cause a down-draught.

Injector Ventilating Burners and Gas-Fires.

In the experiments, the air-opening into the test-room was altered gradually; and the quantity of air removed by the ventilating-lighting burner was deduced by the composition of the gases passing up the flue or from their temperature. Both methods were employed at times. The experiments were made with and without injector tubes. They show that, with an opening of 144 square inches into the room, when the burner was consuming 39 cubic feet of gas per hour (the full gas consumption), the air removed was 93·5 cubic feet per cubic foot of gas burned; but that, when the injector-tube was taken away, the air removed was 143 cubic feet. This indicated that the injector-tube was not only useless, but detrimental in its effect on ventilation (under the conditions of the experiment), presumably because of its frictional resistance. When the gas was lowered to 11·5 cubic feet per hour, the ventilating effect rose to 285 cubic feet per foot of gas burned, which shows that the take-off tube was really too small to be an efficient ventilator with the full gas consumption.

Practically the same conclusions are shown in connection with the application of the injector principle to gas-fires—that is to say, as applied experimentally in these tests. One of the results cited shows that the actual volumes of air moved per cubic foot of gas burned were 194 cubic feet with the injector attachment, and 222 cubic feet without it. The results indicate that, so far as ventilating effect is concerned, a special injector device of the type used has no advantage over a simple thin plate opening into the flue; and, in fact, it has a slight disadvantage, because it increases the resistance to flow. That the total area of opening into the main flue is the determining factor is also said to be clearly shown. There is a positive note about the summarizing passage of the report: "We have not found in any of our tests that the injector principle as applied—by leading products of combustion at nearly normal pressure along a narrow tube, with a view to their inducing a flow of air along an encircling or apposed air-duct, and so increasing the total volume moved—has any validity."

Gas Consumption and Flue Areas and Lengths.

In connection with gas-ventilating and other gas-using appliances requiring a flue, we are afraid that the determination by some makers of the sizes of flue in relation to the maximum quantity of gas consumed has been more or less of an empirical nature—for example, the ventilating lamp flue with which the experiments already referred to were made. A suggestive part of the report treats of investigation regarding this matter; for the experimental work and the tabulated results will form some approximate guide to makers in deciding upon the sizes of flues in which the high temperature and consequently lightness of products of combustion are used as a means of moving air. In the experiments, the gas rates have been reduced to the equivalent of gas having a net value of 130 calories (516 B.Th.U.), as it is clear that, if this reduction were not made, the ratio of air moved to gas rate would decrease as the calorific value diminished. Calorific value is therefore an important factor; and it may be suggested, too, in view of the variable quantity of air required for complete combustion according to the composition of gas, that composition is not a negligible quantity. It is also important that burners should not be placed too near a flue-pipe taking off the products of combustion if maximum and regular flow is desired. Comparing the figures given in the report for various tubes, it will be seen that the volume moved up a 6-inch tube is more than four times that moved up a 3-inch tube of the same length, at the same temperature, probably because the circumference and, therefore, the skin friction do not increase so rapidly as the area. The results of the experiments afford a means of fixing the relation between the length and area of flue-pipes and the amount of gas which can be burned to give efficient ventilation. Since the ratio of air moved to gas consumption diminished gradually as the gas rate increases, it is impossible, the report states, to fix an optimum gas rate. It is, however, convenient to fix a certain desired ratio of air moved to gas burned, and to tabulate the conditions of securing that ratio. Choosing ratios of 100, 200, and 300, the amount of gas required for pipes of different lengths and diameters within certain limits is given in one of the tables. With a flue temperature of 150° C. above that of the outer air, the ratio of air moved to gas burned is 100; and although more exact figures should be taken from the tables, it may be said that, at any ratio below this, a proportion of the gas is being consumed with little or no ventilating effect. As the ratio rises, the effectiveness of each cubic foot of gas for ventilating purposes increases. As an example of the practical application of the results in the tables, supposing a lighting burner, consuming 30 cubic feet of gas of 130 calories net per hour, were available for ventilating purposes, what size pipe would be required to make efficient use of this heat? From the table it is seen that 9 feet of 6-inch pipe only gives a ratio of 172; but 9 feet of 9-inch pipe gives a ratio of 300, and 9 feet of 12-inch pipe a ratio of 443 cubic feet gases per cubic foot of gas burned. Since a ratio of 400 cubic feet per cubic foot of gas burned can be secured with a gas-fire and suitable auxiliary opening, and since a much larger percentage of total heat is available for ventilating purposes with a burner than with a fire, the ratio 400 does not, in the Committee's opinion, seem unreasonable as an immediate practical objective. For a gas consumption, of 40 cubic feet per hour, it would be attained by the use of a tube 12 inches in diameter and about 12 ft. 6 in. long.

Approval and Criticism.

After Mr. Harrison had summarized the report, it was learned with regret from Professor Smithells that the Committee are likely to soon lose the services of their Research Chemist; but, as both the informant and Professor Cobb say, he will take with him the gratitude of the Committee and the members of the Institution for the industry and ingenuity he has displayed in carrying on the research. For the most part, the comments on the report were complimentary, but there was a part that was not altogether so. There was acceptance of the report by Mr. J. H. Brearley (who is a member of the Committee) as disproving that an inner tube accelerates the passage of air and products of combustion through a flue. It is also his opinion that the work should not be discontinued until we have arrived at some data as to the application of gas to the ventilation not only of public buildings but of dwelling-houses. It is the opinion of Mr. George Helps that there are those among manufacturers who have carried out work on this subject, and who could render the Committee some assistance. The work undertaken by the Committee appeals to Mr. Jacques Abady as being thoroughly admirable; and he is glad to see that they are going to continue the investigation under practical everyday conditions. In his judgment, the work has exploded the old falacy as to the inner tube exercising any injector action. Given a satisfactory inlet to a tube, one cannot, possibly, by inserting an inner tube, add to the extraction capacity of the inlet or channel. There was a point of criticism. It is as to the use of calories, temperature in Centigrade, and pressure in mm., after thousands of pounds have been expended in fixing-up for this country a calorific value standard in which British thermal units and not calories, total heat value and not the net, temperatures in Fahrenheit, and pressures in inches have been adopted. There was caution in Mr. H. M. Thornton's remarks. He put it no higher than that "apparently" the report has exploded a theory in regard to ventilation that might have a

very serious effect in some directions—the directions evidently being among manufacturers of injector ventilating devices in connection with lighting and heating. Another point in his remarks indicated to those concerned his view that, the subject of ventilation being a vital one to the gas industry, it would have been better to have taken the manufacturers into consultation, by their representation on the Committee, and to have investigated the research work they have already carried out into this question for a great many years. Mr. J. F. Simmance also accused the Committee of not having looked into the history of investigations into this question. He gave a sketch of the history of ventilating-lamps; and it is evident he is not enamoured of modern lamps with mantles, owing to the altitude at which they are fixed, and, as he imagines, the difficulty there is in keeping the mantles in order. He rather thinks there is a heavy destruction of mantles. But Mr. W. D. Helps has at his back practical experience of a large order with mantled ventilating-lamps; and he showed that there is, through the ingenious devices adopted, no trouble in attending to mantles and burners, nor is there any undue destruction of mantles. A point Mr. Simmance made in criticism of the experiments of the Committee is in their use of an iron flue. The flue should be insulated, so as to limit the loss of heat put into the flue. Professor Cobb was not called upon to reply to the discussion. But a proof of the remarks made was sent to him; and he has written a reply, which appears at the end of the full report of the discussion elsewhere.

A Blow to the Nation.

The foregoing ended the morning sitting. Before the members returned in the afternoon, news had been circulated in London of the death of Lord Kitchener, through the sinking of H.M.S. "*Hampshire*." On the reassembling of the members, the President, in graceful terms, referred to the irreparable loss the nation had sustained in the death of a great man, a true soldier, and a fine organizer. Honour was done to his memory by the members rising in their places.

Thermal Phenomena in Carbonization.

In order to complete, in the Institution "Transactions," the account of the investigations into the "Thermal Phenomena in Carbonization" by Mr. Harold Hollings (Gas Research Chemist 1912-14) and Professor John W. Cobb, a short supplementary report was at this stage presented by them. It is exactly two years since the first report was submitted; and the information in the present document appears to be rather belated, seeing that it was in the summer of 1914 that the further investigations were carried out, and that on May 17, 1915, the matter was the subject of a paper before the Chemical Society. There appears to be little reason why the supplementary report should not have been presented to the Institution twelve months since. As it is, the conclusions constituting the report have been in the possession of those interested for a considerable time now. On Aug. 10 last year, we published an abstract of the paper read before the Chemical Society, and gave its text on Oct. 5, pp. 24-26. The conclusions which constitute the main part of the present report were published *literatim* on the latter occasion. The experiments were carried out with cellulose, dehydrated cellulose, lignite, and different types of coal. Commencing at 345° C., cellulose shows a strong exothermic reaction, which is absent in the coals. Between 400° C. and 600° C., oils, unsaturated hydrocarbons, higher paraffins, and oxygenated compounds are produced in quantity and quality dependent on the nature of the coal; and the thermal phenomena are varied in corresponding degree. Between 600° C. and 800° C., methane is evolved; and all the coals display marked exothermicity in passing through this temperature interval. Above 800° C., hydrogen becomes the main product of distillation; and beyond this temperature the process is either thermally neutral, or, more probably, slightly endothermic. Thermal phenomena at low temperatures, the reporters also state, are only marked with cellulose and coals of a high oxygen content; while phenomena at high temperatures are most marked with anthracite and coals of low oxygen content. The adoption of the report was moved by Professor Cobb, and seconded by Mr. Samuel Glover; and it was agreed to by the meeting without discussion.

A Generous Gift to the Benevolent Fund.

At this stage, and sandwiched between other business, the Benevolent Fund gained the ears of a greater number of members than usual by the report and accounts being presented and their adoption moved by the President, seconded by Mr. W. E. Price. The discussion chiefly turned on the question of the deficit, and the response that has been made to the special appeal for funds to balance income and outgoings. Members should remember that the claims on the fund do not diminish, and are not likely to, and that, unless subscribers and subscriptions are increased, deficits, if the fund is to be administered with the best effect, will continue to harass the Committee. A good suggestion was made by Mr. W. W. Woodward that a permanent Hon. Secretary should be appointed in each county to collect subscriptions for the fund from all gas engineers. It was the pleasure of Mr. Price to announce that the President had generously made a bequest of £100 to the fund; and this is going to be invested, so that the proceeds will be available year by year for the fund. Mr. H. E. Jones was appointed Trustee in place of the late Sir Corbet Woodall.

Life of Gas-Meters.

The preliminary report on this subject was next submitted. It is the work of Dr. R. Lessing, the Research Chemist to the Joint Committee of the Institution and the Society of British Gas Industries, to whom has been referred the investigation of the conditions affecting meter life. The report is, in the promise of success, a complete justification for the appointment of the Committee, and engaging in the inquiry. There has been quite an epidemic of trouble of recent years; and this points to something in the modern circumstances—either inherent in the meters themselves, or through introductions by the gas of depreciating substances, or both causes—that has brought about increased deterioration. From the report it looks very much as though the principal causes will be chargeable to the gas. At present, however, there is nothing positive upon which to proceed. But Dr. Lessing is not leaving a single direction unexplored from which the trouble may proceed. Thoroughness is the keynote of the investigation and of the report. Every one of the components of the meter within the area of mischief is being investigated—particularly the oil or other mixtures used for dressing diaphragm leathers, the leathers themselves, and other material; and then the constituents of the gas are undergoing rigorous exploration in order to drag to light the actual sources of harm. No less than 160 samples of meter liquids and materials have been submitted to Dr. Lessing. He has even brought home with him from the United States (where they are not suffering from corresponding trouble, though they did a number of years ago) samples of liquids and meter parts, so as to extract information from comparison. But the causes of the troubles of years ago in the States and here now may be entirely different; seeing that the meter makers in the States have realized improvement by standardizing and centralizing the manufacture of meter parts. The makers there have one factory for the manufacture of mechanical parts, and a tannery of their own in order to ensure the quality of the diaphragms.

Indictment of Impurities and Naphthalene Solvents.

It is, however, pretty obvious that, as matters stand at present, the British meter makers are likely to be absolved from blame; for Dr. Lessing seems to be, so far as his search for causes has gone, distinctly persuaded that "the deposition of liquids in meters appears to be the chief factor affecting their life detrimentally." Later, we get this accentuated in the section dealing with the "Action of Gas upon Meters." "The evidence," says the reporter, "supplied by the analysis of meter liquids, leaves little room for doubt that ordinary town gas has a very considerable action upon meters." And again: "The analytical examination of a great number of meter liquids so far carried out leaves little doubt that most of the above causes are at work during the use of a dry meter. The action of the hydrocarbons influences the decay of leather. The moisture and particularly the acid constituents of the gas are principally responsible for the corrosion of the metal parts of the meter." There is additional arraignment of gas at the end of the report in the section headed "Considerations Submitted."

This was not pleasant hearing for those gas engineers present at the meeting; and it will not be pleasant reading for those who were not present. The text of the report must be studied to ascertain how far Dr. Lessing is justified from his work in arriving at these conclusions. The components of town gas which are likely to be arrested in meters are: Condensible hydrocarbons, organic sulphur compounds, tar fog, oil fog, water, dust, and compounds such as ammonia, hydrogen sulphide, or cyanogen, which may combine chemically with the materials used in the construction of the meters, or with the deposits already introduced into them. With the specific treatment of town gas for the recovery of war essentials, a fair opportunity for investigation is not just now offered. But it is clear that, whether present in the free state, or in the form of ammonium salts, the compounds named are bound to have a corrosive influence upon the metal parts of a meter, and equally so upon the leather diaphragm. Chlorides have also been found in some cases; but it is probable that this is due to the acid and fluxes used in the soldering process. Thiocyanate is present in practically all meter liquids; and it is not unlikely that this is due to the interaction of ammonia with carbon bisulphide in the gas or dissolved in the meter liquid. Tin, iron, and hide substances in the meter liquid bear material witness to the validity of Dr. Lessing's contention as to the destructive influences at work upon the metal parts and the leather diaphragm. The very substances originally introduced for the protection of the leather are washed out, and the leather becomes dry and brittle. Some suspicion is cast on the practice of using petroleum hydrocarbons or tar distillates of comparatively high boiling point for the purpose of naphthalene removal. These are apt to be arrested or scrubbed-out in the meter, dissolving and extracting the oil in the dressing of the diaphragm, and exposing the bare leather to the chemical action of the corrosive gas or vapours.

Deficient Scrubbing Capacity and Meter Destruction.

There is another point for the gas maker. The meter, Dr. Lessing says, acts as a most efficient scrubber, and retains traces of the destructive impurities referred to until, by cumulative process, they assume, in course of time, fairly considerable proportions—this being at the expense of the life of the meter. "In certain cases"—let this be particularly noted—"it has been found that companies who suffer largely from an excessive number of 'repair meters' admitted, upon inquiry, that they were actually short of scrubbing capacity." There is good ground in gas-meter destruction for changing this condition as well as in the loss of ammonia. Dr. Lessing believes in checking his findings by establishing the contrary conditions; and among his suggestions is found one that the experiments should be supplemented by tests on finished meters with the same gas completely and incompletely freed from cyanogen, hydrogen sulphide, and ammonia.

Meter Repairs and Savings.

The discussion on the report was an interesting one; and it is clear that the members are persuaded that a piece of work is here under investigation that is going to have material effects. This is the pronounced view of Mr. A. E. Broadberry, who pointed to the hundreds of thousands of pounds annually expended on the repair of meters; and so there is good ground for belief that the investigation will be of financial benefit to the industry. The hope that the work would be expedited as much as possible was voiced by Mr. Robert Watson, because the sooner accurate results are arrived at, the quicker will gas undertakings begin to save upon the large sums of money now being spent upon repairs. As to meter diaphragms being affected by the use of petroleum, he does not find that the percentages of unaccounted-for gas of undertakings using it are excessive, nor that their meter repairs are extraordinarily large. His experience is that it is the small meters that break down most frequently. In the small meters, the diaphragm works in the liquid accumulated at the bottom of the case; and this may have something to do with the decay of the leather. His suggested remedy for this is a deeper case, so that there is room for the liquid without the diaphragm working in it. In his opinion, this meter question is one in which there ought to be no sparing of funds for research. Mr. Thomas Glover (Edmonton) is convinced that there is in the report information which will result in a substantial saving to gas undertakings, if only the lessons are applied. As to Mr. Watson's complaint that small meters depreciate more rapidly than larger ones, of course they are made of lighter material.

It is considered by Mr. J. P. Leather that the report proves he is right in using wet meters as much as possible. He also brought out the fact that small meters are subjected to heavier work than they used to be. The difference in the material of which cases are made is one factor in meter life; and he is persuaded that the tin-plate cased meters of the present day have not anything like the life of the meters that used to be produced. Mr. H. Kendrick made the very striking statement that meter repairs in his case have been 50 per cent. more the last ten years than in the preceding ten years. He is under the impression that the increased depreciation is due to the differences in the process of gas manufacture. A suggestion fell from Mr. Thomas Glover (Norwich) that one deteriorating influence is the amount of free oxygen in gas. Where an engineer is obtaining (say) 13,600 cubic feet of gas from a ton of coal, it is possible that there is a little free oxygen in the gas. Whereat there was laughter, but not denial. Free oxygen has a deteriorating effect on iron. In his opinion, dry meters should be a proper piece of engineering work, and not be put together like a piece of clockwork. Mr. James W. Glover (Chelsea) gave some information about the actual lives of meter diaphragms, and as to different materials that have been tried by his firm.

In his reply to the discussion, Dr. Lessing remarked upon the difficulties of investigating the effect on the life of meters of changes in gas manufacture, owing to the differences in the treatment of gas having been accentuated the last year or two. A question for solution is, Are meters to be made that will stand the action of the gas, or is a gas to be made that will not injure the meters? A difficulty in respect of the first limb of the question is that there are a few million meters already in use that cannot very well be scrapped. However, Dr. Lessing ventured to assert that the quality of gas has changed rather more than the meters; and an important point to ascertain is as to the extent to which the causes of injury by gas can be removed without materially altering the quality of the gas. He cannot see that the percentage of unaccounted-for gas can be any criterion as to deteriorating effect on the life of gas-meters, seeing that so many other factors influence the amount of unaccounted-for gas. He finds that attempts that have been made to provide different fabrics for diaphragms have not been very successful.

Elevations in Office.

The report of the Scrutineers was then presented. It will be found set out in full in the general report of the proceedings. There was applause of the heartiest as the name of Mr. A. E. Broadberry was announced as the successor of Mr. Young in the Presidential Chair. The new President has always been an active supporter of all organized effort; and he has a large, intimate experience of all the work associated therewith. We cordially wish him the fullest success for his year of office. Mr. Samuel Glover has (as he himself puts it) "slid" into the Senior Vice-Presidency from the Junior Vice-Presidency, and his seat in the lower office is now equally worthily filled by Mr. Thomas Berridge, who called the members' attention to the fact that they were bringing the manager of a small works into a high position, and all he could say was that he would do his level-best in it.

Honorary Members.

The President of the Société Technique and Captain M. H. P. Riall Sankey, R.E. (ret.), of gas-engine fame, had their names placed on the roll of Honorary Members.

Next Meeting and Votes of Thanks.

London was selected as the fit and proper place for next year's meeting; and after votes of thanks had been passed to all who had taken part in the work of the Institution during the past year, as well as to the Council of the Institution of Civil Engineers for the use of the meeting hall, the interesting day's proceedings ended.

GENERAL REPORT.

THE Annual General Meeting of the Institution was held last Tuesday—there being both morning and afternoon sessions—at the Institution of Civil Engineers, Great George Street, Westminster, S.W. Mr. JOHN YOUNG, the Engineer and Manager of the British Gas Light Company's Hull Gas-Works (the President), occupied the chair.

There was a good attendance of members and visitors; the number present, at the opening of the proceedings, being about 250.

Confirmation of the Minutes.

The PRESIDENT, who, on rising, was received with hearty applause, said: Gentlemen, the first business is the minutes of the last annual general meeting. I will ask Mr. Woodward to move a resolution.

Mr. W. W. WOODWARD (Salford): I beg to move that the minutes of the last annual general meeting be taken as read and confirmed.

Mr. J. H. BREARLEY (Longwood): I have pleasure in seconding that, Mr. President.

The PRESIDENT: Gentlemen, the motion proposed by Mr. Woodward and seconded by Mr. Brearley is that the minutes of the last general meeting be taken as read and confirmed. Is it your wish that this should be done?

Carried unanimously.

The Late Sir Corbet Woodall.

The PRESIDENT: Gentlemen, I have now to move the following resolution:

> That the members of the Institution of Gas Engineers and visitors present at the annual meeting on the 6th of June, 1916, have received with profound regret the announcement of the death of Sir Corbet Woodall, D.Sc., M.Inst.C.E., who had occupied the position of President on three occasions.
>
> They desire respectfully to offer to Lady Woodall and her family the expression of their sincere sympathy, and to place on record their appreciation of those high personal qualities which had endeared Sir Corbet to all.
>
> His eminent professional attainments, the invaluable services he rendered the gas industry in so many ways, and particularly his recent munificent act in providing the Corbet Woodall Scholarship for the benefit of gas engineering students, will always be gratefully remembered.

I received a few days ago a letter from our esteemed colleague, the President of the Société Technique du Gaz en France, of which the following is a translation:

> *Société Technique de l'Industrie du Gaz en France,*
> *94, Rue Saint Lazare, Paris,*
> *May* 23, 1916.
>
> Dear Mr. President,—I have the honour of conveying to you, in the name of the Committee and all the members of the Société Technique de l'Industrie du Gaz en France, the expression of our deep sympathy on the occasion of the loss which your Institution has sustained in the person of Sir Corbet Woodall, Past-President of the Institution of Gas Engineers, and Honorary Member of our Society.
>
> The notable character of all his work, the eminence he had attained, his wide experience, his competence in dealing with every question of financial and industrial interest, were rightly and universally appreciated.
>
> A man of such integrity and ability who passes away leaves behind among those who knew him widespread regret, in which we join, and of which we beg you to accept the expression of our sincere assurance.
>
> I am, dear Mr. President and Colleague, with expressions of highest regard,
>
> (Signed) ROULAND, President.

You have heard the resolution. I ask Mr. Broadberry to second it.

Mr. A. E. BROADBERRY (Tottenham): Mr. President and gentlemen, I beg to be allowed to second this resolution. I have been personally acquainted, intimately acquainted, with Sir Corbet Woodall for so many years that I feel very keenly the loss that the industry generally has sustained—and those who knew him intimately have sustained—by his death. The good he did will be remembered by us for very many years; and I beg formally to second the resolution.

The PRESIDENT: I will ask you to signify your agreement with this resolution by rising in your places.

The members rose silently.

Appointment of Scrutineers.

The PRESIDENT: The next business is the appointment of Scrutineers to examine the ballot lists for the election of officers and members of Council for the ensuing year, and of members and associate members. I will ask Mr. Hardie to propose a resolution.

Mr. WILLIAM HARDIE (North Shields): I beg to move that Mr. Hubert Pooley and Mr. W. G. S. Cranmer be appointed Scrutineers.

Mr. HERBERT LEES (Hexham): I have much pleasure in seconding that.

The PRESIDENT: The proposition is that Messrs. Cranmer and Pooley be appointed Scrutineers. It is carried unanimously. Mr. Cranmer and Mr. Pooley, we are deeply indebted to you for the work you are about to do.

The President's Address.

The PRESIDENT then delivered his address, which will be found in last week's "JOURNAL" [pp. 497-9]. When he had resumed his seat,

Mr. THOMAS GLOVER (Norwich) said: It affords me particular pleasure to move a vote of thanks to our President for the excellent address which he has given to us this morning. The particular pleasure is enhanced by the fact that Mr. Young is a colleague working under the same respected Company, is my senior in service, and was my forerunner at Norwich; and I have always entertained the highest respect for his kindliness and friendship. What I have expressed personally, is in the minds of you all; for I know you entertain the same feelings towards Mr. Young. He is ever ready to give us any help that he is able to do. He is a good one to consult and to have as a friend; and we are pleased and proud to see him in the chair. The surprise to us is that he has not been "discovered" for the position before; and we knew, when he did arrive there, he would fill the chair worthily and well. We have not been disappointed in the address. It is a stirring address, and one which is worthy of the times. It is appropriate to the times. He has reviewed the position quite as well as the best forerunners in the chair could have done; and we thank him very much for the stirring words with which he closed the address. We thank him for working-up our patriotism to a greater height. I hope that patriotism will show itself in a greater extraction of benzol. ["Hear, hear."] We thank him also for reading that letter from Lord Moulton. There is no lack of appreciation by the authorities of what we are doing; but there is sometimes a lack of appreciation of this appreciation by gas engineers who are not doing quite enough. We thank him for drawing attention to the present importance, and future prospects, of the oil-washing process. We thank him for his reasoned and reasonable review of the coal position, because in that he gives us hope and he gives us guidance. We recognize in Mr. Young one who, long before the formation of the British Commercial Gas Association, was carrying on the same type of work at his own place, in advertising and pushing the uses of gas for all the purposes for which it is so well adapted; and we cannot think of anyone more capable of helping in the further organization of the industry than our President. With these words of appreciation of Mr. Young's address, I beg to move that our heartiest thanks be given to him for that address.

Mr. CHARLES WOOD (Bradford): It is a very great pleasure to me to have an opportunity of seconding the vote of thanks so ably proposed by Mr. Glover. Mr. Young is well known to every one of us; and we are all his friends. I never heard anybody say an unkind word of him. As a neighbour of mine, I have felt very much for him in the special difficulties through which he has had to pass during his year of office, owing to the geographical position of the

city in which he lives. The portion of the address bearing on the extraction of benzol and the prospects of the process being continued after the war, is, I think, very important ["Hear, hear"]; and no one can speak to us with better authority as a gas engineer on the subject than Mr. Young. I feel that he is right in every word he says in regard to this, and that after the war the various processes will still be at work, and be required perhaps quite as much as at the present time. I have personally listened to the address with the greatest possible pleasure.

The motion having been put to the meeting by Mr. Glover, and carried with acclamation,

The PRESIDENT, in reply, said: I thank you exceedingly for thanking me. If I have said anything to-day that will be of any assistance—either in the way of encouragement or in any other way, so long as it helps you in your work—I am more than repaid. I am, in fact, grateful for the opportunity of doing so. The few thoughts I have given you have been jotted down in very peculiar circumstances. There is so much ground that so many have trodden, and so much forbidden ground which no one must tread just now. Sometimes when wandering about the streets on duty as a special constable these thoughts have come across my mind. I had hoped to be able to give you something very much better; but, as I have already said, if you are pleased I am more than grateful. Thank you very much.

Annual Report and Accounts.

[The Report appeared in the issue of the "JOURNAL" for May 23, p. 392.]

The PRESIDENT: I beg to move that the annual report of the Council and the statement of accounts, a copy of which has been sent to every member of the Institution, be taken as read, and that they be adopted.

Mr. J. P. LEATHER (Burnley): I have great pleasure in seconding that. I think the report shows that the Council are not dead, though so many things have to be postponed in these days. In spite of hindrance by the war, they are still working, and preparing at any rate for what may be done later.

The PRESIDENT: The report and accounts are now open to discussion, if any members have anything to present to the meeting.

Mr. C. E. JONES (London): In the first place, Sir, let me personally express the pleasure I experience at seeing you in the chair. It is a great honour indeed to us to have as President a gentleman whose heart and soul are in the business of advancing the gas industry. On the report itself, I may be permitted to say a word or two. I read it with much interest, and it reflects the greatest credit on all concerned. I think the highest praise should be accorded to those who have contributed to this important production, which, to my mind, marks a departure in the right direction which has been advocated by myself and others years ago. I had a note or two on Lord Moulton's letter; but as you, Sir, have read it, it will be incorporated in the proceedings, and I will pass it on one side. I will go on to what to me at all events is a matter of considerable pride, and that is the honours accorded to certain members of our Institution. Sir Daniel Ford Goddard, already a Member of Parliament, is now a Privy Councillor. We know that such distinction is well deserved. As to our old friend Mr. Harry Jones (as he is familiarly called), we have to congratulate him on the high honour he has secured from the Institution in whose theatre we are assembled. [Applause.] I am exceedingly pleased to see him present this morning. For 47 years he has been a member of the parent Society, and for 41 years he has been on the Council. And now he is advanced to the position of Vice-President, which means that before long he will occupy the chair as President of the Institution of Civil Engineers—the highest honour, I conceive, which can be bestowed upon anyone connected with the engineering industry in this or any other country. [Applause.] Mr. Dugald Clerk, D.Sc., is well known all the world over; and we also accord him our hearty congratulations. I am very proud indeed to see the members of our body being recognized from the outside. They have deserved it long; and I hope they will live long to enjoy it. Turning to the Board of Trade circular, while we are very anxious to increase the material from which the high explosives are manufactured, it does appear to me to be a strange anomaly that we should be advised in our capacity as gas consumers to use as little gas as possible. I have not obeyed that injunction, but have largely increased my domestic gas consumption. We should use more gas now, as we are producing what is recognized as of supreme importance to our Army and Navy in the greatest war that history has ever recorded. We should do all we can to increase the supply of benzol and toluol which is so much needed at the present time. It is a strange proceeding, I take it, on the part of the Government, to whose vagaries we are unfortunately getting accustomed. They seem to want to win the war by the prohibition of gas consumption and the use of large posters on the walls; and I can only say there never was a war yet in which our forefathers adopted such practices. There are just two other points I should like to mention. You will remember that the last time we met I thought the Council had been somewhat remiss in not recognizing more fully the work that had been done by the industry, which had furnished such a large number of men for the front; and the result was, I believe, the preparation of a Roll of Honour. I am very pleased at that. Then there was the recent triumphant passage of the small collier boat up the Thames. This boat—the "Wandle"—by the foresight of the Chairman of the Company, was armed, and was able to destroy one of the submarines of the enemy. I think we should record that feat in some form or other in our "Transactions." As the Chairman of the Company is here, I ask that we give him our thanks for what he has done. [Applause.]

Monazite Sand Supplies.

Mr. S. B. LANGLANDS (Glasgow): I was wondering if the Institution are going to do anything in regard to research on monazite sand. I do think we are losing an opportunity in this direction; and the matter may well be put before the Research Committees of the Universities. We all know how this industry so far has been in the hands of enemy countries. I would like to thank the Technical Press for the stand they have taken. I think we should go farther, and try to get these fields in British Possessions in our own hands; and research work should be carried out. I think this is a matter which could quite well be taken up by the Institution of Gas Engineers.

The Question of Organization.

Mr. GEORGE HELPS (Nuneaton): I look round to see how many of you are going to get up; and I see you have left it to me again. [Laughter.] There is not very much I have to worry you with this morning. If you will give me your indulgence for three or four minutes, I can say all that I want to say. It is on the question of the organization of our industry. To me it is the most important thing there is before us this morning. Outside of this there is nothing great in the report. The President has told us that there is a National Gas Committee, in which I understood him to say there are seven members of the Institution of Gas Engineers, seven of the Society of British Gas Industries, and seven of the British Commercial Gas Association. I have some doubt as to what the composition of the Committee will be who are to consider this organization of the gas industry, because in the report it says that a special meeting of the Council will take place. I should like to know, Mr. President, if it is a special meeting of the Council, or whether the Council are going to call in others to help them. I take it that when gentlemen sit together for so long as they do in connection with this Institution, their views become all more or less of the same sort. I can imagine so; and that is one thing which we, as a live industry, have to strive against. We want differences of opinion; and the more men of different opinions you can get to this conference, the better will the gas industry be organized. ["Hear, hear."] Let us have as many opinions as we can, and have them hammered at and forged into one solid view. Then we shall go forward. These are all the remarks I have to make on this matter.

Mr. HARRY JONES (who was received with loud applause) said: Mr. President, may I be allowed to make a few observations on a point that is prominent in your address, and has been touched on here? I have also to acknowledge the very graceful expressions of my namesake, which have been so heartily and kindly received by you. As

to the fusion of organizations, there are two aspects of this question. There is first of all the scientific element that alone can exist in the Institution of Gas Engineers; and I trust when they seek evolution or fusion with any body or any system whatever, they will not fail to remember there is in the Institution in whose hall we are meeting, there is a body which does command your proper ambition to be affiliated with. I have long had a feeling of regret that there were not more members of the gas engineering profession already on the roll of this the Mother Institution of all professional engineering institutions in the world. Our members number many thousands, and pervade almost the universe. There is no reason why any institution of an engineering character should not be associated with, and affiliated to, the Institution of Civil Engineers. I humbly acknowledge the compliment paid me by my colleagues in selecting me for the Council and afterwards by the members in electing me Vice-President. It is a very great distinction; and I feel very unworthy of it. I will do my best; no man can do more. Then there is the commercial aspect of fusion. It is not always that you have the possibility of combining good business administration with a pure scientific training; but the combination does exist. It existed in the gentleman whose loss we are all deploring to-day—Sir Corbet Woodall. It existed in Sir George Livesey; and it exists partly to-day, for instance, in Mr. Milne Watson, who has been selected as Managing-Director of the Company of which he had previously been General Manager. But they are distinct functions of the same mind and the same brain; and believe me, Sir, they should be kept separate. The chemical and engineering science necessary to evolve the best results from the construction of plant and then the operation of it, is entirely separate (say) from the making of meters, stoves, pipes, cast or steel, or other manufactures. I am a Director of the Gas-Meter Company—not doing so very well in these war times, with the high price of tin, and the low prices you gentlemen pay for the meters. I am not ashamed of the position; but I am not so proud of it as I am of being the old Engineer of a Gas Company, and of being for 47 years a member of the Institution of Civil Engineers, and 12 years a member of the Council (not the period mentioned by Mr. C. E. Jones). But there is also a third aspect, and that is the legal and parliamentary aspect—the legislative conditions of our industry; and there you will remember that I am the Chairman of the Gas Companies' Protection Association. Now, this is an Association which, though its title is very wide, is strictly confined to protecting the industry from adverse legislation. You will remember the fight a little while ago against the alkali people, who wished to restrict us from doing the very work which the War Office have been asking us to undertake, in connection with sulphuric acid, phenol, toluol, and benzol. Let us echo the noble sentiments that you, Sir, have voiced. Let us feel that we are doing our bit for the country, that we are soldiers in a sense, and that we will leave no stone unturned to send as much high explosive to the front as we can. A legislative institution is distinctly a body which appeals to the shareholder and director. You may call it an industry. It is an industry in a sense. The commercial part of a gas undertaking is an industry; and the science which directs it is the supreme science, and should therefore be at the top and stand distinct. I agree that these representations that have been made to us by almost everybody—I will not say by the cook, housemaid, and gardener, but it is not so far out—should have come from the head of this Institution, not the Institution of Civil Engineers, but the Institution of Gas Engineers. The commercial side is quite separate; and we must preserve a pretty wide distinction in these things, or your Institution will fail indeed. It will fail in the scientific aspect. I hope you will do everything to preserve the professional spirit which is of the very essence of the work that is going on to-day. Now, then, a word about the "Wandle." There was no prouder chairman of a gas company in the wide world than I was when I saw the "Wandle" come back up the Thames, cheered the whole of the way, because the vessel represented the proper British spirit. Shall I tell you the origin of the boat carrying a gun? I have always been a fighting man; and when I read in my papers early in the war of five big liners manned by hundreds of brave Englishmen, without a gun, being at the mercy of a crew of thirty or forty bullying assassins I felt ashamed. I therefore sent Mr. Carr to the Admiralty, and permission to fit guns on our boats was secured. Unfortunately, however, guns were scarce; but for eighteen months the little "Wandle" carried the gun and two gunners that enabled her to strike down that submarine. I say "strike down," though the Captain modestly will claim no more than that he fought it off; for I cannot believe a submarine like that would fail to pursue a little collier, unless she was beaten. The "Wandle" reported when she came in that the North Sea was strewn with the wreckage of ships that had been attacked by submarines in the previous three or four weeks. We must resist this, the same as in the case of the Gas Companies' Protection Association we resisted attempts to impose unfair terms upon a company. In conclusion, and reverting to the question of fusion, I do say you should preserve your professional spirit and identity.

The Current Importance of Oil Washing.

Mr. W. W. Townsend (Colchester): I have only a few words to say; and I am not quite sure whether I am in order in saying them at this stage. The report states a great deal as to the work that has been done; and we are all very grateful to the Council and Committees for the valuable work they have been doing. But there are certain very prominent features which are entirely missing, which one would expect to see fully dealt with. For example, there is the question of washing gas with oil—to my mind the most important question before the industry at the present time. It seems a great pity that this year, of all years, it has been necessary to cut down our proceedings to a one-day meeting, because if ever there was a time when gas engineers should "get together," it is now. Very many of the members come a long way to the meeting; and they could spare two days just as well as one. Apart from that, there are other important matters; and we should spend our time more profitably in discussing them than in going into matters which are ordinary every-day practice. A good many prominent members of the Institution consider the question of benzol extraction has been settled because they have stated their views on it. I do not think that settles the matter for the majority of the members. We all have different conditions, and want more information than has been given. There have been valuable discussions by District Associations and Commercial Sections; and it seems that if the Institution is any good it should have thrashed out the problem as an Institution. Thus we should get the benefit of the experience of members all over the country, and possibly be able to take steps immediately. That seems to me the most important thing. I am not saying this by way of any criticism of the Council in their arrangement of the proceedings. We all know that every gas manager now is very much harassed. We are all very short of men. But I do think if an effort were made even now, we might get up a meeting and have a full debate on at any rate one or two of the most pressing problems that confront us at the present day. ["Hear, hear."]

The Coming Conference.

Mr. R. G. Shadbolt (Grantham): Might I suggest, Mr. President, that you should answer now Mr. George Helps's point with regard to the National Gas Committee.

The President: The National Gas Committee, which has already been mentioned, was called together yesterday to discuss the question of a fuller representation of the interests of the gas industry as a whole. There was a full attendance of representatives from the Institution of Gas Engineers, the British Commercial Gas Association, and the Society of British Gas Industries; and the only desire in the mind of each one was the furtherance of the best interests of the industry. It was not long before an agreement was come to that a conference should be held. I may tell you the composition of the conference which was suggested. It is the Council of the Institution of Gas Engineers, the General Committee of the British Commercial Gas Association, the Council of the Society of British Gas Industries, and the Committee of the Gas Companies' Protection Association. The full Council of each will be asked to attend a conference to be held before the end of this month; and I have very little doubt that, with such a representative body as they seem to be, a working arrangement will be come to which will enable the National Council to represent fully every phase of the gas industry. Now, gentlemen, we have a good deal to do, and time is getting on. I will ask members to be as brief as possible.

Members of Alien Enemy Birth.

Mr. J. W. Buckley (Hornsey): On the membership list of the Institution, there are no less than five members of alien enemy birth; and it does occur to some of the members to question whether we maintain the dignity that we ought to do by allowing these gentlemen to remain as members of our Institution. ["Hear, hear."] I do not propose to move any resolution. It will meet with my wishes if you, Mr. President, can make some promise that the question shall receive the attention of the Council.

The President: It will certainly have the attention of the Council.

The Position of Administrators.

Mr. F. W. Cross (Lea Bridge): As to the question of this higher organization, do you think you are aiming high enough? The gas industry is now principally represented by executive officers. Have you, as executive officers, the power necessary to go to the Government in these present times? I am speaking only of war times. The executive officer has to receive his instructions from his Board. The board of a company are the administrators. They administer the business of the company, and not the executive officer. The executive officer acts upon the instructions of the administrators; and I think you are not aiming high enough unless you aim at the administrators of gas companies acting in every way at the present crucial time to meet the Government and secure advantages for the gas industry. I think executive officers are not able to go to the Government with the full power of the members of the board of a company—I am speaking, of course, collectively. In these days, there are conditions of all kinds to be met; and I just want to put forward the idea that you are not aiming high enough in getting the right sort of men to deal with the national questions of our industry at the present time. I am not speaking of every-day questions of the works, but of coal and the other administrative factors in connection with gas-works. I think that you want to aim somewhat higher.

Mr. F. W. Goodenough (London): With reference to Mr. Cross's remarks, the conference which you, Mr. President, outlined just now as meeting to discuss the question in the course of the present month will include something like forty chairmen and directors of gas companies. That will, I think, probably meet Mr. Cross's point.

The adoption of the Council's report and the statement of accounts was then unanimously agreed to.

Refractory Materials Committee's Report.

[For the report, see p. 579.]

The President: Now we have to receive the report of the Refractory Materials Research Committee, which is to be presented by the Chairman of the Committee, Dr. Colman.

Dr. Harold G. Colman (London): Mr. President and gentlemen, in moving the adoption of the report of the Refractory Materials Committee, I do not propose to go into the details, but rather to confine myself to certain general considerations arising out of it. This Committee was formed in the first instance as the result of the paper read before the Institution by Major Bywater in 1908; and from the formation of the Committee, Major Bywater has acted as Honorary Secretary, and has undertaken the lion's share of the work. We all of us deeply regret his absence during the last two years, answering a higher call of duty; and we hope for his speedy return to join in the work once more. When the Committee was formed, its objects were, generally, three in number. In the first place, it was acting in conjunction with representatives of the manufacturers to promote investigation and research and obtain improvement in the material supplied for refractory purposes in gas-works. In the second place, it was to carry out as far as possible any research work on fundamental points of a general nature which were of vital importance in connection with the industry as a whole; and, thirdly, to draw up a specification of tests with which materials supplied should comply, in order to be suitable for the conditions met with in general gas-works practice. Attention was first devoted to the drawing-up of a standard specification of the tests to be complied with for the different classes of material. In drawing-up such a specification, it is not possible to stipulate for such tests as would be complied with by an actually ideal material for the purpose. One has to be guided to a large extent by the existing state of the industry, and what can be done; and in these tests that were drawn-up the minimum or maximum specified was such as was found to be complied with by the better class of materials on the market. It had to be remembered that too narrow a specification would mean that there might not be enough material corresponding to it to go round. It was, and is, the intention that these tests should be stiffened-up as time allows, and as the improvement in the industry permits. There was, and is, no intention to interfere generally in manufacturing details. That must be the part of the makers. Only in one respect, and that solely in reference to one class of goods—namely, retort material—was there anything in the specification which had reference to methods of manufacture. It was generally agreed that the grog used in the manufacture of retorts should have the fine dust taken out; and this was specified. Unfortunately, it is retort material said to have been made in accordance with the specification that has given most trouble. In many cases the material supplied has given very satisfactory results; but in a number of others it has not done so. In a large proportion of these latter cases—occurring shortly after the specification was issued—the trouble arose, not from the specification, but from a misreading of it by some of the manufacturers, who took out a great deal more of the finer matter of the grog than the real dust, and also [and this can in no way be inferred from the specification] employed very large-sized grog in the manufacture of the retorts. There are other instances in which the standard specification material has failed to give satisfactory results; and on inquiry it has turned out that this material had never been tested to see that it actually complied with the tests laid down in the specification. This is a matter of considerable difficulty, of course, because comparatively few works have the necessarily expensive apparatus for carrying out these tests in a satisfactory manner. The question of stiffening-up the tests has been before the Committee very many times; but it is felt that at the present juncture it is impossible for them to recommend any such course, though they hope before long to be able to do so. Before, however, this is done, a considerable amount of research work is necessary in that respect alone. Another portion of the specification which undoubtedly requires reconsideration and modification is that relating to silica and silicious material. In the report issued just before the war, reference was made to this matter; and results obtained in the last few years make the reconsideration of this subject very necessary. The information already available has been very largely added to during the last fortnight by the very valuable paper read by Mr. John West before the Manchester Institution. But all these questions of research which is necessary from the point of view of the Refractory Materials Committee do involve a very considerable sum of money. The Committee have gone as far as they can with the money at their disposal; and this means that the available funds have been small. It happens that this matter of refractory materials involves probably at least as complex chemical and physical problems as any other industry. In fact, they are comparable with those of the metallurgical industry; and when you think of the hundreds and thousands of pounds spent on research work in that industry before advances have been obtained, it is not, I think, surprising that progress in the refractory materials industry has not yet gone very far. Unfortunately, again, from the very nature of the work, at very high temperatures, that has to be done, the cost of equipment and of running the tests is unavoidably high. If our research is to be extended, therefore, it will inevitably involve the outlay of considerably greater sums of money than we have hitherto spent. I should also like to point out that it would have been utterly impossible for the Refractory Materials Committee to have done even the work they have done, but for the fact that the Stoke-on-Trent Pottery Laboratory Committee generously allowed the use of their apparatus, and Dr. Mellor carried out the work—in both cases at a cost to the Committee which would not cover even the working expenses. In response to our application to the Advisory Committee of the Privy Council for Industrial and Scientific Research, we have received a grant for this year of £130, which, added to the £50 from the Institution of Gas Engineers and £50 from

the Society of British Gas Industries, gives to the Committee a fund of £230. This is a very considerable increase on the amount they have previously had. On receipt of this sum, we have at once considered the putting in hand of further research. But, directly, we find that the preliminary expenses of plant will absorb the whole of the £230; and if this research work is to go on to a much larger extent than at present, more funds will have to be provided. I know that just now the provision of funds is exceedingly difficult, and that this is not the only research which is wanted and which will require funds. But I do think this is a time for us to lay our plans for getting more money if possible in the future. That such expenditure will repay itself, I have no doubt in my own mind. It will not lessen the necessity for manufacturers to carry out research work on more special problems, nor will it make any less necessary research on works to see that materials are used in the most appropriate way; for however suitable it may be, if the settings are improperly designed, constructed, or worked, no material will ever stand. The total sum spent on such research will, of course, be very great, as in other successful industries; but in the long run, though slowly at first, it will bring about, I believe, a steady improvement in the quality of the goods. That it will bring about a reduction in their price, I do not prophesy, and I do not expect. The cost of making them will be greater; but provided we get a higher quality, this increase in first cost will be far more than compensated for by the greatly lengthened life of the settings, and perhaps even more by the avoidance of losses caused by interruption of work owing to failure of material. The users have a right to demand that, if they are going to pay an increased price, they shall be assured of getting a really improved quality; and that is what is, largely owing to lack of knowledge, not by any means always the case at present. At the same time, the manufacturers have an equal right to demand that their material shall be used in a proper manner, and that failures due to improper construction of settings, and so forth, shall not be put down as the fault of the material. Now, I have only one more point, we appreciate very greatly the grant we have received from the Advisory Committee of the Privy Council; and we recognize that, though the sum is in itself a small one, the number of demands upon the Advisory Committee was very large. The sum granted them by the Government only amounted to £30,000 for all the requirements of industrial and scientific research in Great Britain and Ireland. That is far less than has been spent in the preliminary investigation of many a successful process. The grant bears a very fair proportion to the amount we ourselves have spent in the past on the research. We hope, however, the Government subsidy of this research will be largely increased, and that we may in the future be able to receive more assistance from them. An old proverb says—"Heaven helps those who help themselves;" and in this respect now, I think, the Government will resemble heaven. The more we ourselves have expended in research work generally—I am not referring to research upon refractory materials alone—the greater is the assistance we are likely to receive in the future from the Government. ["Hear, hear."]

The PRESIDENT: I beg formally to move the adoption of the report.

Mr. J. P. LEATHER (Burnley): I have pleasure in seconding the report. I do not know that I have very much to add to what Dr. Colman has said. I think we ought to recognize that the problem before the Committee is an important one, and not only important, but, as has been practically conveyed by Dr. Colman's remarks, it is a large one. That is to say, it is not possible of solution in a few weeks, but it wants a considerable amount of time, in order that we may get all that we ought from this research. Researches of this kind—in fact, scientific researches of any kind—cannot be planned out beforehand. If you knew what the result was going to be, there would be no use in making the research. It really means discovery; and until you start, you do not know what you are going to meet with, and what difficulties you may have to overcome. The work so far has been quite preliminary; and we are only just now seeing our way to going a little further forward. It is like climbing; until we get to the top of the first hill we do not know what is on the other side, nor how many more hills there are to surmount. The report does not include, but I think most members have fairly recently seen some reference to what has been done, some of the work that Dr. Mellor set about. He had got apparatus, and so forth, for doing certain things, and then found that, practically speaking, he was no further. He learned something for all that, though it was nothing which could be placarded about as a great achievement. He found out a little more about the difficulties before him. No doubt for a few years we shall still be finding further difficulties—further tops that have to be surmounted before we reach anything like finality. I can only emphasize what Dr. Colman has said, that it will require, and does require, considerable expenditure of time and money, if we are going to arrive at the ideal results which we hope we shall ultimately achieve. Surely, this question of money is a very small matter, if only it is properly viewed. It intrenches a little bit on the question in so many minds and mouths this morning—the question of the organization of our industry. We here only represent the professional or executive branch of the management of gas undertakings; and, of course, it is not exactly for us to find all the money for doing something which is to benefit the undertakings which we represent. It does seem that in some way the industry, as an industry, should contribute towards the cost. The question, for instance, of the quality of retorts and fire-bricks, is one on which the expenditure of a few hundred pounds is practically nothing. There is hardly a large undertaking represented here that it would not pay to spend the same sum of money as we are spending as a whole in this research in the course of the year. They would get retorts and refractory materials generally which would last 50 per cent. or more longer. Take the case of retort material, if we have been in the habit of paying 4s. or 5s. per foot, it would pay to give 10s. if we got double the life. We should reap a great deal more than the extra expenditure amounted to. Therefore in the organization of the industry one of the things we should consider is whether we cannot get further subscriptions for this work. I have no doubt when we do get to work with the new apparatus which is now on order—it is not easily obtained in these days—it will give us something which will show the use of this Committee—use which will reveal itself in increased profits for the industry.

Mr. J. H. BREARLEY (Longwood): May I suggest that, instead of discussing these reports, we get through with the programme. In the time we have at disposal, it will not be possible to do justice to them now. Members might submit comments on the reports in writing to the Secretary, to be published in the "Transactions." In this way we can get forward to the presentation of the other reports. It would not be fair if we did not allow time for them to be presented.

The PRESIDENT: Personally, I think the suggestion a very good one. If the members approve, it will save us a considerable amount of time; and it will add greatly to the interest of our "Transactions," if the questions relating to the reports are carefully considered and as carefully written about. Of course, members will be good enough to adopt this report in the meantime. Does that meet with your approval?

Professor JOHN W. COBB (Leeds University): May I say a word as to this? We, I believe, do not require very many minutes for the presentation of our report. I think Mr. Brearley and the other members of the Committee will agree with the Chairman and myself that we should very much like to give the meeting an opportunity of discussing the report. If we leave it for written communications, experience shows there will be considerable loss by the process. Many people may speak now who, owing to pressure of other duties, may not afterwards give us the benefit of their contribution to the discussion.

The PRESIDENT: The report before us at present is that of the Refractory Materials Committee. If any member has any observations to make, will he please be as brief as possible.

Mr. H. KENDRICK (Stretford): I should like to say a word, as we have heard the apology of Dr. Colman and Mr. Leather for having done nothing during the past twelve months. On referring to the balance-sheet, it is quite evident, from the small amount put down there—less than £24—that very little has been attempted; but why that has been so, I am quite at a loss to understand. In the Publicity and Special Purposes Fund, some £18,000 is collected,

if my memory serves me right. Ten per cent. of this was entitled to be transferred to the Special Purposes Fund, but only slightly over 5 per cent. has been transferred; and then, again, even of this 5 per cent., you carry forward the large sum of £368. It seems to me that a good deal of the money could have been spent on expediting the work which Mr. Leather says is so important, and which means to us, if we are to get a better class of retorts than we have been in the habit of getting in the past, that it will be money very well spent indeed. I rather hoped to have given Mr. Leather a chance of "dressing me down" on this subject, as he wanted to do twelve months ago; but he has already spoken. I said a year ago, and I repeat now, the retorts we are getting, or have got in the past, under the specification are very little (if any) better than those we were getting before the refractory materials specification was in existence. Dr. Colman says we ought to get them tested, to see if we are getting retorts up to the specification; but I think most of us are dealing with firms of standing, and that we should give them the credit that a great many of these firms are entitled to. It is an aspersion on the character of these firms that we should question the quality of the goods they are supplying. I do not see any reason why we, as individual gas undertakings, should go to the expense of the plant Dr. Colman refers to for the purpose of testing their materials—particularly as the makers should bear a large part of the expense of testing these things themselves. Besides, we are certainly being called upon to spend more on this material; and this increased cost ought to cover a very considerable portion of the expense of carrying out these experiments. ["Hear, hear."]

Mr. H. E. Copp (Etruria): May I ask whether it would be possible for this investigation on refractory material to be conducted collaterally with the investigations now proceeding in the matter of firing pottery. I ask the question for this reason. I know a large amount of expensive apparatus is being provided for the investigation on pottery firing, and a considerable number of very high temperature gas-furnaces are also being installed for the purpose. Although there is nothing in common between the two industries, I do not see any reason why some arrangement should not be arrived at by which the apparatus may be used for both purposes. ["Hear, hear."]

The President: I will now ask Dr. Colman to reply.

Dr. Colman: I have very few remarks to make. With regard to Mr. Kendrick's point about insulting our friends the manufacturers by testing the things they supply, I must confess that leaves me entirely cold. I cannot well imagine (say) Armstrong, Whitworth, and Co. feeling insulted because the Admiralty test stuff to see that it complies with the specification. ["Hear, hear."] Really it seems to be quite ridiculous. We are entitled to see that our stuff complies with the specification; and we must absolutely insist upon it. I have no doubt any representative of a manufacturing firm present would agree with me in this. Would it be an insult by the local authority to venture to test a company's gas to see it was up to standard? Certainly not. It is not an insult. I am fully in agreement with what Mr. Copp has said; and it is exactly what we have been doing. We have been working in conjunction with the Stoke-on-Trent Pottery Laboratory Committee. We have had to put up additional special apparatus for particular tests; but in the main we have largely used apparatus which they have for their purposes. This will continue to be done in the future. With regard to the actual amount expended in the past year, I would point out that the bills have only come in this year for the apparatus, and will come into the next accounts. That will make it a very different story. The amount now shown was simply out-of-pocket expenses incurred last year.

Mr. H. E. Bloor (York): Has the work of the Committee the whole-hearted support of the manufacturers, or are they hostile?

Dr. Colman: So far as the manufacturers are concerned, all I am able to speak for is the Committee. We have had whole-hearted co-operation from them.

The report was then adopted.

A Message to His Majesty.

The President: Before we proceed to the next business, I should like you to authorize me to despatch the following telegram to His Majesty.

> Members of the Institution of Gas Engineers in annual meeting assembled desire to send dutiful message of loyalty to His Majesty, and respectful assurance of their determination to continue efficiently the work being carried on by them in connection with the supply of high explosives.
>
> John Young, President.

Is it your wish that I should send this telegram?

The members signified by loud applause their desire that this should be done.

It may be stated that the following reply to the telegram was subsequently received:

> *Buckingham Palace, O.H.M.S.,*
> 5.20 p.m., June 6, 1916.
>
> The King thanks members of Institution of Gas Engineers for their kind message, and greatly appreciates the assurance that their work in supply of high explosives will be effectually maintained.
>
> Stamfordham.

Ventilation Research Committee.

[The report is given on p. 580.]

The President: We will now proceed to receive the third report of the Ventilation Research Committee, which will be introduced by Professor Smithells.

Professor Arthur Smithells (Leeds University): Mr. President and gentlemen, the introduction of the report by me is very much a matter of form. It gives me an excuse for being here; and I need hardly say that it is always a very great pleasure to me to attend the annual meetings of the Institution. The report will be presented by Mr. Harrison; and Professor Cobb, who has been in close supervision of the work, will also offer some observations on the subject. So far as I am concerned, I need mention one or two points only. I think, in the first place, we were fortunate in being able to continue this investigation in the past year. It is now exceedingly difficult to keep any scientific research in progress which is not directly or indirectly connected with the war. But in this particular case we have succeeded in retaining the services of Mr. Harrison; and the research has been brought to a certain definite point—not to completion, but to the completion of the first chapter. The demand for chemists is now unprecedented; and I am afraid it is hardly to be hoped we shall be able to continue with Mr. Harrison in the service of the Committee for another year. But I sincerely hope that the research will not be interrupted; for it has now reached the very interesting stage at which the conclusions arrived at by the investigation, and under restricted conditions, will be applied to actual circumstances as they exist in ordinary dwelling-houses and in buildings of different kinds. The only other thing I need say is that the Committee have been very zealous in their work. Every member has been most greatly interested in the work, and also—which is most important—entirely disinterested. The meetings have been very interesting, owing to the great variety of experience which has been brought to bear from different sides. I am tempted, in view of what has been said by previous speakers, to become irrelevant, and to speak of the vital question of the relationship between research and industry. But I will refrain, Mr. President. I will only say this—that I think the example the Institution has afforded by co-operation with the University of Leeds, is one that has arrested the attention of the Advisory Council appointed by the State; and I have a great hope that the example which your Institution has afforded will be looked into very carefully, and may lead to developments in the same direction, which cannot fail to be of enormous importance to the country. ["Hear, hear."] Just one word more. I think we are very unlikely to have much longer the services of Mr. Harrison; and I should like to say on behalf of the Committee how very much we have valued his help. He has been most industrious. He has shown great ability and originality; and he has carried out the work with the utmost care. It has required a great deal of drudgery to be faced. It has called for much resource, and a great deal of repetition. It has often been dreary; and it has lacked the inspiration which comes from the hope of making great discoveries. The work has meant the traversing of ground where many have been before, and trying to bring order where many half-truths have been

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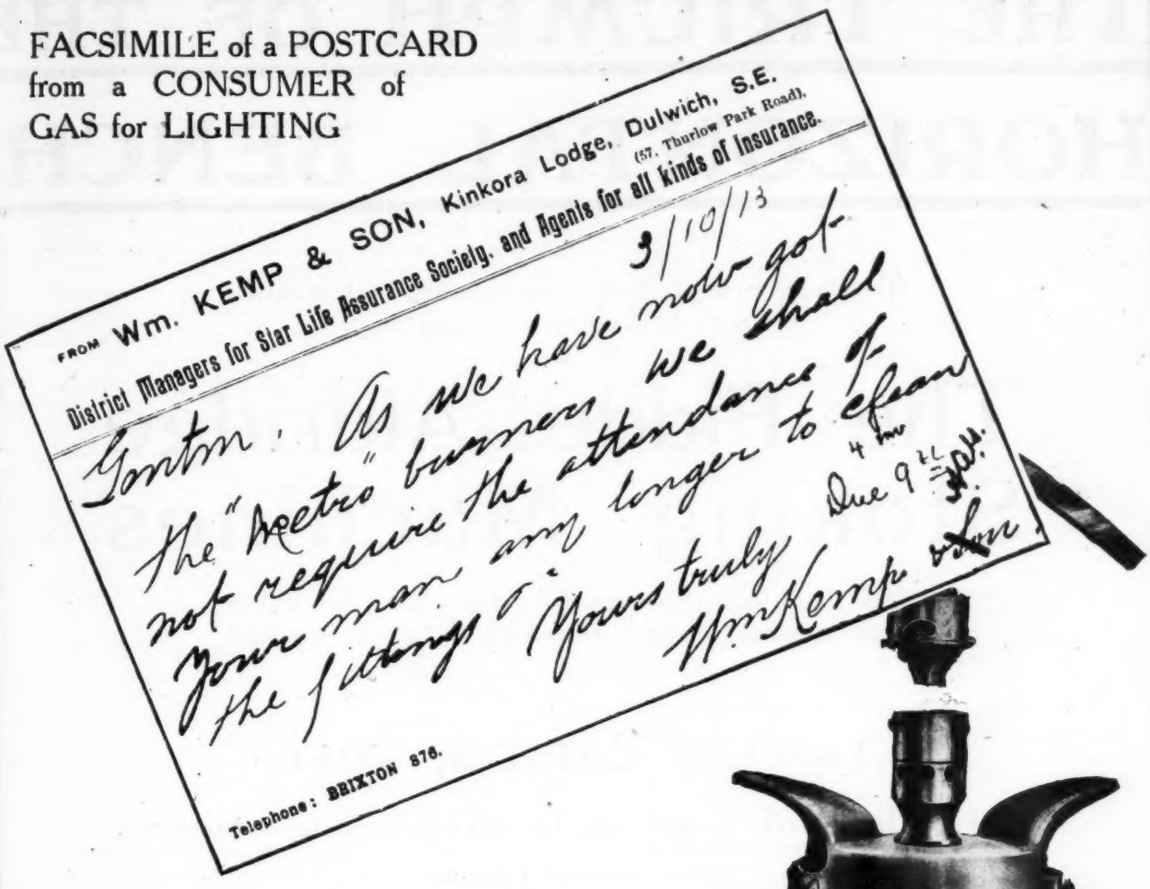
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discovered, and where many unsound dicta are common. In this work, Mr. Harrison has done very well indeed; and the Committee wish to make warm acknowledgment of his services.

Mr. WILLIAM HARRISON (Leeds University): The first part of the report deals with the question of down-draught. It was clear at the outset that to make a large-scale investigation into the causes of down-draught would require a large number of experiments to be carried out on many installations in all kinds of weather; and even then it might be difficult to arrive at any definite conclusions. For this reason, an attempt was made to work under standard conditions, which could only be obtained on a small scale. The results obtained in this way show that there are at least two conditions of down-draught—one increased static pressure in the air near the outlet of a chimney, and the other natural currents of air passing in a somewhat downward direction over the chimney. Although these are not the only conditions for down-draught, they are often met with in actual installations, and result from the action of wind on chimneys and the roofs around them. The second part of the report relates to the application of the injector principle to ventilating gas-burners and gas-fires. The injector principle is applied in the bunsen burner with some success; but one is likely to overlook the fact that energy is required to put the gas under pressure before the injector action can be produced. Since the efficiency of an injector is certainly below 100 per cent., it follows that it would be more efficient to distribute the energy evenly throughout the gases in the wide tube of the bunsen. However, in the bunsen burner the efficiency of the injector is of little importance, providing it is sufficient to give a mixture of air and gas of proper proportions moving at a sufficiently high velocity, from gas already supplied under pressure. In gas-burners and gas-fires, the advisability of adopting the injector principle to induce ventilation depends primarily on the efficiency of the injector; and since this will certainly be below 100 per cent., there seems to be no reason to adopt this principle for ventilation. Our experiments confirm this view, and show clearly that less air is moved with a system having an injector tube than with one without. The third part of the report deals with the volume of air moved up flues of various sizes by different consumptions of gas. At the outset, the experiments were made with the greatest possible care, with the intention of securing very accurate data for the purpose of deducing a formula. However, many sources of error were found which made it impossible to get this degree of accuracy; and attention was therefore paid to multiplying the readings as much as possible. The results are given in curves from which tables have been constructed. The results show that, in order to obtain a large volume of air moved per cubic foot of gas burned, the temperature in the flue should be kept as low as possible consistent with maintaining the head. In practice, the dimensions of the existing chimneys in a building place a limit to this reduction in temperature; and any tendency to restrict these dimensions is obviously a mistake. It is, moreover, undesirable to introduce deliberately a further limitation by the restriction of the area of the flue-vents of gas-fires.

The PRESIDENT: Mr. Harrison has briefly summarized the report. I take it Professor Cobb will move its adoption.

Professor JOHN W. COBB (Leeds University): Professor Smithells has introduced the report, Mr. Harrison has given a summary of it, and the complete report itself is in your hands. As I promised Mr. Brearley, we have not taken up much of the time of the meeting in presenting the report, because we hope there will be forthcoming an adequate discussion. At the last meeting, the only criticism that was levelled at us as a Committee was that our report was not issued early enough to allow of it being considered and criticized. I think we have this year remedied that deficiency, and we hope the discussion will prove it to be the case. I should like to take the opportunity of endorsing all that Professor Smithells has said with reference to the zeal and ingenuity displayed by Mr. Harrison in carrying out the work, and to the regret they would all feel at the loss of his services, which seemed likely to come about. I beg to move the adoption of the report.

Mr. BREARLEY: I have very great pleasure in seconding that, and cannot do better than follow the admirable example of Professor Cobb and be brief, so that members can express their own views. I have already taken part in several discussions relating to the work in this report; and I personally, as a member of the Committee, should welcome inspiration from the general body of members as to the future work. I should like to express my admiration of the manner in which Mr. Harrison has carried out the work entrusted to him by the Committee, and I am very sorry we have to lose his services, when the report has reached such an interesting stage. We must hope we shall be able to go forward, and at least make tests of practical installations in actual use. There is just one point that has kept us from making the progress we should otherwise have made, and that was the necessity for clearing the ground of the half-truths to which Professor Smithells has alluded. Among these half-truths, I venture to think that one very common one was that the inner tube of a ventilating shaft was an advantage. We all know that ventilating burners are constructed with an inner tube fixed in the outer one; and I do not mind confessing that even I held the opinion that the inner tube accelerated rather than retarded the travel of gases in the ventilating shaft. This is clearly disproved by the work of Mr. Harrison; and that is an example of half-truths having to be removed from the path before we could get on with the real solid work. One important fact I wish to emphasize is that 1 cubic foot of gas of 500 B.Th.U. will raise the temperature of 25,000 cubic feet of air approximately 1°. If we keep this figure in mind, we must realize how valuable gas can be made as a ventilating agent. I do not think this work should be discontinued until we have got some practical data as to its application, not only to public buildings, but also to domestic utility services. I have great pleasure in seconding the adoption of the report.

Mr. GEORGE HELPS (Nuneaton): Will you allow me just three minutes in which to say that I have spent three years experimenting in the making of lamps; and it occurs to me to suggest that the Committee might apply to gas-lamp makers, and get some information from them as to what experiments they have carried out in the past in regard to making high and low pressure lamps windproof. I have not considered very much whether this is of interest to the Committee in this research work. I can only say that, after humbugging about day and night for three years on that line, making all sorts of experiments, and spending close upon £1000, I found myself at the end of the period with very little more knowledge than I had at the beginning. True, I had got a lamp absolutely windproof—it withstood a hurricane a little while ago—but I did not know why. That may be interesting to the Committee. There are lamp-makers in the room who, I am sure, would be only too pleased to give some of their experiences in this way. I may say how much I, having spent all this time, am able to appreciate the work of those gentlemen who are dealing with this particular matter; for among all the dry jobs, I cannot imagine a drier.

The PRESIDENT: We have specially invited a number of friends interested in this question; and I see some of them before me. I hope they will, please, for the moment consider themselves as members; and we shall be delighted to hear their views on the subject. We will give them the necessary time to enlighten us.

Mr. JACQUES ABADY (London): As one of those you have alluded to, Mr. President, I rise to say a few words. Next to giving the German High Sea Fleet a little occasional ventilation, there is nothing so good for the constitution as a well-ventilated room; and with the excellence of design which characterizes modern gas-fires, it is almost superfluous for us to say that there are no means of so well ventilating a well-ventilated room as by a well-ventilating gas-fire. The research which the Committee have undertaken seems to me to be particularly admirable; and one thinks rather pathetically of them measuring the amount of air passing up tubes, with possibly bombs from Zeppelins dropping all round them. It has been pointed out that what has been done is preliminary research; and that they have yet to apply the information obtained to the rough-and-ready test of practical conditions in which there exists no standardization. But if the Committee have really done nothing else at the present juncture, they had done a good

deal in exploding the old fallacy of the inner tube and the outer tube, and the modern application of that to the so-called injector principle in gas-fires; for, Sir, given a satisfactory initial inlet, you cannot possibly add to the extraction capacity of that inlet or channel by putting other bits of pipe or sheet iron round. Of course, it is obvious that the more annular spaces you make, the more do you increase the skin friction, thus going from the goal rather than towards it. One point of criticism I want to express as strongly as possible. This is an Institution of Gas Engineers; and this report is presented by a Committee of the Institution. The Institution, if it had a corporate neck, has been breaking that neck for years to try and establish a certain standard to express the principal product that the members are responsible for making—namely, gas—and after a great deal of time and trouble, many years of parliamentary agitation, and thousands of pounds spent, they have established the right to express the quality of their gas in terms of British thermal units gross per cubic foot, at an atmospheric pressure of 30 inches, and a temperature of 60°. This report, however, contains an investigation in which this standard basis has been totally disregarded, and the results expressed with the gas rate in cubic feet per hour reduced to 0° C. and 760 mm. pressure, and 130 net calorific value. I think that is absolutely wrong, and the sooner these results are converted, the better. ["Hear, hear."] I think my criticism is a fair one, when a member of the Committee refers to gas of 500 B.Th.U. doing something or other. [Laughter.]

Mr. H. M. Thornton (London): I cannot follow the last speaker in discussing this report in such a pleasant way, or in perhaps such a scientific manner; but I should like to add the thanks of the manufacturers for the work that has been done by the Leeds University. I hope that the statement Mr. Harrison has made here will have full report when the Technical Press deal with the matter, because I think it adds materially to what has been stated in the report. I am not proposing to add anything in regard to the details given, except to say that it apparently explodes a theory with regard to ventilation which will have very serious effects in certain directions in reference to gas-fires. Probably there will be a contention that there is another side to the statements made. But the point that occurs to me is, would it not have been far better to have brought together the manufacturing side in regard to the matter of ventilation in connection with gas-fires, rather than to have exploded the theory now, when a great deal of work has been probably done—some years of work in regard to this Institution? I throw it out as a suggestion that on a Committee of this kind manufacturers might just as well have been represented as not, because fortunately to-day the Society that I represent [the Society of British Gas Industries] and yourselves are more or less allied in most things, and surely the subject of ventilation in connection with gas-fires and other apparatus is of such vital importance to the industry that we might as well have had manufacturers on the Committee, as is the case with the Refractory Materials Committee, so that we might have had the benefit of their research work—which is very considerable—and probably have brought forward results which would be helpful to us all. I cannot but feel it would be an additional strength to this Committee, if we had the manufacturers' help in regard to the particular question now under consideration. Please do not think I reflect for a moment on the great work that is being done by the Committee or the Leeds University. The Leeds University were the first to consider the question of the radiant efficiency of gas-fires. The instrument used by them was considered to be perfect, or rather the best at the moment; but since then it has been shown that there are additions which could have been made to that test which probably would have been very helpful at the time. But we are now dealing with the question of ventilation; and perhaps in time we may see that what they have done might have been done better. I am only throwing this suggestion out because now we are dealing again with the efficiency of gas-fires; and if we could get all bodies represented in regard to such things, we should have more finality at an earlier date than if we just deal with it on one side and then tackle it on the other, and afterwards go back to the first again. I thank the Committee very much for what they have done, and hope we shall reach a very much more final stage in regard to ventilation in the near future by throwing out this suggestion.

Mr. J. F. Simmance (London): I had a letter this morning suggesting that I should come and make some remarks on the report; but I have not had an opportunity of going through it at all critically. I think the reason I have this opportunity of speaking is because once upon a time I took out some ventilating patents. When a man takes out a patent, if he is a wise man—I suppose there are very few wise men among patentees—he looks over the field, to see the state of the art. I must say, from the casual glance I have given to the report, that the state of the art was not ascertained when it was written. I should think that the papers which have been read at the meetings of the old Institution cover this question of ventilation far more thoroughly than apparently can be done in present circumstances. Of course, I go a long way back. I should say that there is no point in the report that Mr. Thomas Fletcher has not touched upon—that he has not investigated—and, I must say, that apparently he has not agreed with. Or, I suppose I ought to say, rather, that the present report agrees with Mr. Thomas Fletcher. There are some points which naturally Mr. Fletcher could not deal with at that time. Things have developed since; and I should think the three sections into which the report is divided may be some sort of an index to go by. With regard to the question of down-draughts, the report does not touch upon the one critical point in the matter of ventilation, and that is the essence of the whole business—the maintenance of the temperature in the flue. An iron flue is not a good thing to use under any circumstances, unless it can be so lined—or padded, if I may say so—that the heat which is put into the flue is not lost. As I have said, the whole essence of the thing is the maintenance of the temperature in the flue; and the reason why we get many down-draughts is simply because—perhaps for a temporary reason—the temperature does fall in the flue. In the matter of ventilating by means of gas, it appears to me that you are opening a very big question. It is a question that years ago was quite apposite; but now, if you are going to have a ventilating light, you have to consider the mechanical difficulties of procuring the light in the first instance by means of incandescent mantles. If you are going to light a big room and ventilate it by gas, and put in a central burner, you know there are difficulties; and if the lights are up 50 or 60 feet above the ground, it is going to be a pretty big business to keep them going. If you are not going to have mantles, what are you going to have? Are you going back to illuminating gas? If you are going to send out—as we shall no doubt be doing presently—practically a "blue" gas, this means that you will never have a sun-burner or a ventilating light—except very small lights going through the walls, &c. You have, therefore, to consider what light you are going to use. About 41 years ago, I went to the late Mr. William Sugg; and I have been in this particular line ever since. That is to say, there has been no development in gas lighting or ventilation that has not gone through my hands; and in many cases I have had a great deal to do with them. I am quite certain you are absolutely wasting time in talking about ventilating by gas lighting, unless you first tackle the question of what sort of gas light you are going to use. You are putting the cart before the horse. If you supply "blue" gas, will you have carburation *in situ?* Milne's, I believe, at the gas exhibition put up some beautiful sun-burners in the dining-hall. They looked extremely good; and if this sort of thing can be carried out in a more—I was going to say—practical style, then the point is solved. But it seems difficult to deal with sun burners a long way from the floor, where mantles have to be renewed. To swing the lamps down is a very troublesome job. We remember Strode's burners, and the little trouble they were. They would go on for forty years without touching. Of course, they did not improve; but they would go on working for any length of time. And although you only got 1 candle per cubic foot, it was a particularly efficient gas-light. Then Sugg came along with his big clusters, which gave a total effect of 5 candles per cubic foot, including reflection. That does not seem very much now; but considering they wanted no attention, and would ventilate a room most adequately, while lighting it brightly, I say 5 candles was a very good result. Then we had the regenerative types of lamps, like the "Wenham" and the "Cromarty." They all failed—or, rather, they did not fail, the gas failed. Had the same gas been given then as now—that is, a more regular gas—all these lamps would have succeeded, and the course of gas

lighting would have been totally different. The "Wenham" lamp had very little margin between smoking and not smoking; and if the gas was put up 4 or 5 candles suddenly, the lamp went wrong. But then we were getting 10 or 15 candles per cubic foot; and if it can be worked now, you have a ventilating light, and the whole question solved, except the glass, which will always be a trouble. But what I want to say is that the question of the style of gas-light is an inherent part of this problem of ventilation. Until you have a perfectly arranged light, it is no use talking about ventilation. This question has not really been considered at all. We have to have a tube inside. It is not to draw more air out, but to keep the heat from the rafters. If you put up a sun light with only the outside flue, the insurance companies would not pass it for a moment. There are many other points I could speak about; but what I have said is quite enough for the time.

Mr. W. D. HELPS (Leeds): I am delighted to think my old friend Mr. Simmance got up before me. I have known him for many years, and have always thought he was a man to keep himself right up to date; but there is one thing he has not been made aware of. That is with regard to the convenience of using mantles. I am surprised that Mr. Simmance did not see the moving of the ventilating light at the exhibition to which he refers. As regards getting it up and down, it is a very simple method indeed. We have the lamps fitted at the Leeds Second Division Northern Hospital for ventilating. They have been used during the hot weather for ventilating in the daytime, so as to cool and refresh the atmosphere for the sick and wounded. If it is any information to Mr. Simmance, I may say we have had cases of gas engineers and managers speaking of the long life of the mantles and burners. Gentlemen have even said: "We have had this mantle on for eighteen months." If you only want to attend to these burners every season, we have got to a point which Mr. Simmance says we have not reached. With regard to ventilating burners generally, just previous to the war we were doing very extensive work in ventilation; and we ousted electric lighting, not only from churches and chapels, but also from some miners' clubs. We have several instances in Yorkshire of miners, who smoke strong tobacco, asking us to remove the smoke that filled their club-rooms. They did not like the electric light because it did not get the smoke out. I certainly secured one installation in a Yorkshire colliery district from the fact that the chairman was tickled by the explanation of the power of the inner tube; and I hope we shall not have to pull out this inner tube, because it gives a little to talk about. I suggested that if we made the inner tube a little narrower at the top, when they were smoking objectionable cigars, we should almost draw the cigar up with the bad atmosphere. [Laughter.] They went to see a church which was fitted up, and decided at once to put the ventilating lights in, taking out the electric lights. These gas-lights are there to-day; and the people are going to put up a statue to us. I thank you.

The PRESIDENT: I will now put the motion for the adoption of the report.

Carried unanimously.

Professor COBB writes in reply: On the question raised by Mr. Abady, the units employed are simple and convenient; but the criticism has its justification, and so far as is practicable at this stage, the Committee will have regard to it. Mr. Simmance regrets that he has not had an opportunity of going through the report critically, which detracts, naturally, from the value of the opinions he has felt himself justified in forming and expressing. His remarks have, however, historic interest, and obviously come from one who in the past has concerned himself with the subject of ventilation. It is impossible to share his views on the extent to which our work has been anticipated; but the Committee will, I am sure, thank Mr. Simmance for any useful references he is able to place before them on work published in the past which may have been overlooked. As to down-draught, it is quite true that a cold chimney will not draw; but Mr. Simmance's view—that the maintenance of temperature in the flue is "the essence of the whole business," with its direct implication that down-draughts are not experienced with a warm flue—is mischievously mistaken, and opposed to common knowledge and experience. If, in considering the subject of ventilation by gas-fires and gas-burners, we have placed the consideration of ventilating effect before that of gas-burner construction, it is, it seems, a natural and logical procedure. If we had reversed the order, a charge of "putting the cart before the horse" might reasonably have been brought. If Mr. Simmance means that the influence of burner construction on ventilating effect is of importance, this has been recognized by the Committee, and the results of their experiments on the subject form a portion of the report issued last year. In his search for a combination of heating and ventilating excellence, Mr. Simmance seems to have found it in the "sun" burner at the Shepherd's Bush gas exhibition; and Mr. Helps, of Leeds, seems to agree with him—giving assurances that the mechanical difficulties are imaginary. That the inner tube of such a burner has a heat-insulating influence, is obvious. It has also a mechanical stiffening effect. But if Mr. Simmance is right in his contention that no increased ventilation is understood or claimed to result from the use of the inner tube, then a misconception, so far prevalent as to be shared by the whole Committee, is certainly abroad.

On the questions raised by Mr. Thornton and Mr. George Helps, Professor SMITHELLS (the Chairman of the Committe) writes: Mr. Thornton's remarks as to the inclusion of manufacturers on the Committee are for the Council to consider; but they afford the opportunity of saying two things: First, that the Committee owe a considerable debt to manufacturers for the assistance which they have readily given when called upon; and, secondly, that the Committee will always welcome very warmly any suggestions, advice, or record of experience which manufacturers may be good enough to offer.

This concluded the business at the morning session; the members rising shortly after one o'clock, and re-assembling two hours later, when the sitting opened with a calamitous announcement.

The Death of Lord Kitchener.

The PRESIDENT: Gentlemen, since we left this hall a short time ago, the nation has received news of a terrible disaster. With your permission, I will read the official notice received by the Secretary of the Admiralty this morning from the Commander-in-Chief of the Grand Fleet.

> I have to report with deep regret that His Majesty's ship "Hampshire" (Captain Herbert J. Savill, R.N.), with Lord Kitchener and his Staff on board, was sunk last night about 8 p.m. to the west of the Orkneys, either by a mine or torpedo.
>
> Four boats were seen by observers on shore to leave the ship. The wind was N.N.W., and heavy seas running.
>
> Patrol vessels and destroyers at once proceeded to the spot, and a party was sent along the coast to search; but only some bodies and a capsized boat have been found up to the present.
>
> As the whole shore has been searched from the seaward, I greatly fear that there is little hope of there being any survivors. No report has yet been received from the search party on shore.
>
> H.M.S. "Hampshire" was on her way to Russia.

Gentlemen, the nation will receive this news with a deep feeling of regret, and a feeling of great calamity; but we must not forget that the work will go on. ["Hear, hear."] No one will ever be able quite to take Lord Kitchener's place; but a man will be found who is ready for the emergency, and who will carry on the great work that he has initiated. I feel sure that under the circumstances Lord Kitchener would have wished that the work of even a meeting of this kind should continue. It would, I am sure, be his feeling that business should be as usual; but I think before we proceed further we ought, by rising in our places, to honour the memory of a very great man—a man who, at the crisis, proved to be the saviour of his country.

All present then rose in silence.

Thermal Phenomena in Carbonization.

[Supplementary Report—See p. 579.]

The PRESIDENT: The next business is the supplementary report on carbonization. I will ask Professor Cobb to move the adoption of the report.

Professor J. W. COBB: Mr. President and Gentlemen, When Mr. Hollings and I presented our report on "Ther-

mal Phenomena in Carbonization," what we had done was to take coal and to trace the reactions which occurred as the temperature gradually became higher—noting whether these reactions absorbed heat or evolved it. You may remember that a number of curves were published in the "Transactions" of the Institution. My hope at that time was that we might be able to divide up the carbonization process into a number of periods, which were indicated by these heat curves; and by collecting the products of carbonization which corresponded to each branch of the curve, we might be able to elucidate more clearly successive phases in the many phenomena of carbonization. But pressure of work of various kinds at the University, and war work in particular, has made it seem very unlikely that for some time to come this piece of work, which would occupy much time and patience, could be carried through. So we were left with the option of putting it on one side altogether, or comparing what had already been observed with the chemical results obtained by investigators previously. It so happened that carbonization had been conducted in a very similar way to that on which we had worked in our own experiments; and so we were able to associate, to correlate, the thermal phenomena already traced with the chemical phenomena observed by others. So, without waiting until we could confirm it by our own results, it seemed advisable that, in order to complete our work, at any rate for the time being, the result of that consideration and correlation should be put forward. It is put forward in the supplementary report which is before you. You will notice there an attempt is made to summarize the reactions occurring below 400° C., between 400° and 600°, between 600° and 800°, and above 800°. I think that what seems to be of most practical and immediate interest is probably the rather striking thing that between 600° and 800° C.—that is, the stage of carbonization in which methane is formed in quantity—there seems to be no doubt that no heat is absorbed in bringing about these changes, but heat is actually being evolved. That is to say, the temperature of the substance being carbonized should of itself tend to be raised without the application of any external heat. I think I have perhaps taken up too much of your time regarding what is really a supplementary report, but we should be pleased to answer any questions that arise out of it. I move the adoption of the report.

Mr. Samuel Glover (St. Helens): I have very great pleasure in seconding that, and thank Professor Cobb for leading us so carefully and so concisely to the same conclusion as he (the speaker) himself had been brought to up to now, and for the promise of further work in the future.

The President: We shall be glad to have any observations on the report. If no one has anything to say, I will put the motion for its adoption to the meeting.

Carried unanimously.

The Benevolent Fund.

The meeting then resolved itself (for the time being) into the annual general meeting of the Benevolent Fund. A report of the proceedings at this meeting will be found on p. 578.

Life of Gas-Meters Research Committee's Report.

[The report is given on p. 586.]

The President: We have now to take the preliminary report of the Life of Gas-Meters Research Committee. I propose that it be taken as read. It has been in your hands for some considerable time; and it is of great interest.

Mr. Broadberry: Mr. President and gentlemen, I have been called upon to move the adoption of this report; and I am very pleased to be in a position to say that I think I have attended nearly all the meetings of the Special Committee. A great deal of very important work had been done; but I feel sure you will all of you appreciate that, in starting a research of this description, there has to be a great deal of preliminary work done. First, experiments have to be conducted to ascertain in what direction the research ought to be prosecuted. We know there is need for the research; but at present it is difficult to determine—or it was in the early days difficult to determine—what direction the research and experiment should take. The lines are now becoming fairly clearly indicated; and the future work of this Committee will certainly produce far better results than we have been able to show up to the present time. I hope by this time next year, if funds and opportunities allow, we shall be able to put some very valuable facts before you. It will mean the saving, probably, of a good many hundreds or thousands of pounds that at the present time has to be spent for repairs to gas-meters. The report is a fairly long one; and those of you who have read it will appreciate what I have already said about the difficulties of determining the exact lines on which to proceed. But I assure you that very good work has been done; and this good work will go on with very much greater rapidity in the future. I have pleasure in proposing the adoption of the report.

Mr. Robert Watson (Doncaster): I shall be very pleased indeed to second the adoption of the report. I have been for some considerable time interested in the question of diaphragm deterioration and other troubles that we are getting in connection with meters; and I have had a good deal of conversation with other engineers who have been, like myself, troubled with the diaphragms of meters drying, and causing gas to pass unregistered. As a consequence of these troubles, which I suppose we all experience more or less, and which seem to occur in a greater degree as years go by, I have followed with interest the excellent work of this Committee. The Committee are to be congratulated on the attention they have devoted to the subject, and on the report they have obtained from Dr. Lessing. The complaint (if any) which I have to make is that they have not been quicker in submitting reports of this sort. Mr. Broadberry suggests that in twelve months they will be able to present something of more consequence; and one cannot but feel that in the meantime we shall be spending large sums on meter repairs. This not only affects the gas industry as a whole, but also the meter manufacturers, who, unfortunately for them, have to repair meters inside a five-years' guarantee. Dr. Lessing makes some reference to the various component parts of the meter which may possibly give trouble. He speaks, for instance, of the diaphragms, and of the fact that in America the meter makers have special tanneries which they control themselves, and consequently they can get the leather which is best suited to their purpose. He also alludes to the oil dressing used in meters, and tells us in the course of the report that the solvent action of the oil varies considerably. One would like to know whether the oil used by meter makers is that least likely to be acted on by the gas. There are also several other points that may possibly give rise to concern and trouble. Towards the end, he only makes reference to the action of the gas; and it appears as though the meter makers are altogether absolved from any concern with the meter. I do not think he or the Committee really intended this. There is a reference to the action of benzol, petroleum, &c., which may be used for enriching purposes or for keeping naphthalene troubles in hand. Dr. Lessing, I think, suggests that this has a good deal to do with the trouble; and that it is the presence of liquid in the meter which is the "chief factor"—that is the expression he uses—in producing breakdown of meters. At various times, I have looked through the Government returns relating to gas undertakings; and I find that where benzol, paraffin, &c., is used the unaccounted-for gas is not appreciably greater than in other undertakings. Their meter repairs, also, are not particularly heavier. This rather indicates—and is borne out by letters I have received from engineers of large gas-works using benzol—that it is not this altogether which causes the trouble to-day. I am not suggesting what is the trouble; that I cannot do. In my experience, it is the small meter which breaks down most frequently. I have very few cases of large meters coming to grief in this way. If one examines a small meter, like a three-light, and notices the depth to which liquid accumulates in the case, one cannot help feeling that the diaphragm is constantly working in this liquid; and, if so, the liquid may have a solvent action and denude the leather of its oil, and thus have much to do with the trouble. The question is whether meter makers would be well advised to give a deeper case, so as to allow the greater clearance which we get in the larger meters. This matter is one of very great urgency. It means a considerable amount of money to gas undertakings each year; and unfortunately the meter is an instrument we do not know much about until it breaks down. It may be slowly failing, with monetary loss for

several years. I do hope, in spite of the various kinds of work the Council may have to do, they will not delay their investigations in this matter; and I do think, so far as the money at their disposal from the Research Fund is concerned, we ought not to stint them in the slightest.

The PRESIDENT: We have invited some friends who are closely interested in the work of the Committee; and we shall be glad to hear from them in the matter.

Mr. THOMAS GLOVER (Edmonton): It is with very great diffidence that I venture to put before you my views on the question; but, as you said, it is a matter in which we are intensely interested. And I should like to say that it is a matter with regard to which we, as meter makers, are quite unable to make much progress unless we can get the very hearty co-operation of all those who use the meters. In this connection, I would direct your attention to one paragraph towards the end of Dr. Lessing's report, where he indicates that the meter may be in some measure the receptacle, or the arrestor, of certain ingredients of the gas; and therefore the meter makers do not have an opportunity of going into the matter as closely as they could with your co-operation to test and deal with the gas as sent out to the consumer, and before it gets into the meter. We, as meter makers, value very much the opportunity of co-operating; and I feel convinced that before long we shall be able to put before you results which, as Mr. Broadberry suggested, will save considerable sums of money to your undertakings. With regard to the report, as a member of the Joint Committee, I should like to say that personally—and I think here I am speaking for those who are associated with me in the Society of British Gas Industries—I regard the report more as indicating the lines on which the investigation should proceed, and feel that it is rather too soon yet to draw any definite conclusions. ["Hear, hear."] Mr. Watson touched upon one point in the report on which there is some difference of opinion, when he referred to Dr. Lessing's remarks about diaphragm leathers. I do not wish to put my personal views before you at this juncture. All I would say is that I do not think we ought at the present stage to take these conclusions with regard to diaphragms by any means for granted. I am familiar with the methods adopted in America, and know something of the methods prevailing in this country; and I do not think the differences in practice are quite so wide as are indicated in the report. Mr. Watson, I think, mentioned that it would be of great value if results could be given quickly. I do not, however, see that there is much prospect of this, because the deterioration, if any takes place, in the meter or the substances of which the meter is made, is due to two factors, of which time is not the less important. Therefore, in my opinion, it must be some time before any definite conclusions can be arrived at. Mr. Watson mentioned the question of small meters, and suggested that possibly they failed more rapidly than the larger ones. Again I do not propose to make any definite statement; but I would ask you to consider the fact that the smaller the meter as a rule the thinner is the substance of which its component parts are made. This, apart from the work done, may have something to do with the more rapid failure of the small meter. I have marked a good many points, and could say a lot more; but I will only thank you, on behalf of the meter makers of the Society of British Gas Industries, for the opportunity given us of co-operating with you in this research work.

Mr. LEATHER: I am very much interested in this report from one aspect, and that is that it shows I am right in not using dry meters any more than I can help. [Laughter.] I do not think we have ordered two dozen dry meters in the last dozen years. That is one point that makes this report specially interesting to me. I would also suggest that there is, at any rate, something in the fact that small meters are much more heavily worked now. Certainly, I have had very heavy meter repairs in the last dozen years; but this is almost entirely due to the fact that we have broken-up most of the two and three lights, and that meters are replaced out of revenue. There is another thing. I do not know whether Dr. Lessing refers in his report to the difference in the material of which dry meters are made from what used to be the case. I think the material of the cases (which is certainly one factor in the life of the dry meter) is tinned steel, instead of tinned iron. There is not the slightest doubt that the tin-plate of the present day has not anything like the life that it used to have when it was charcoal iron.

Mr. KENDRICK: Mr. Watson has made a statement that an examination of records leads him to a certain conclusion. I made a similar examination which led me to an entirely different one. So far as gas-works are concerned which are now using benzol and petroleum for naphthalene troubles, no doubt the unaccounted-for gas he referred to might be affected from the fact that very few works add to the total make of gas the vapour represented by the benzol and petroleum spirit added to the gas. Consequently, the unaccounted-for gas in these cases would appear lower than is the actual fact. Then with regard to meter repairs. Conversations I have had with Lancashire gas engineers go to the opposite extreme to Mr. Watson, and show their repairs are extremely heavy. In my own case, with over 50 per cent. of dry meters—which were not my putting in, but my predecessor's—repairs in the last ten years are quite double those of the previous ten years. I think we shall find, as Dr. Lessing suggested, it is from the difference in the manufacturing processes of the gas-works.

Mr. S. Y. SHOUBRIDGE (Lower Sydenham): I should like to make one suggestion to the Committee. The dry meter to-day is practically the same as it was fifty or sixty years ago; very little (if any) improvement has been made upon it. Is it not possible for them to discover, or to invent, some material other than leather for diaphragms? We have been having leather ones all these years; and at the end of this time they are proving anything but perfect. It seems to me it should be possible to find some other material that would answer the purpose better; and I would just ask them, when they have ascertained the cause of the deterioration of these diaphragms, to turn their attention to finding out whether some more suitable material cannot be adopted in future.

The PRESIDENT: If no one else has any observations to make, I will ask Dr. Lessing to reply.

Dr. R. LESSING (London): I do not know whether I can reply in detail to the points raised. It would practically mean going over the report, because some of the matters have been dealt with. I must preface my remarks by saying that it is only a preliminary report, and, as has been pointed out by Mr. Broadberry, the difficulty was in the last twelve months to find out the lines on which research should proceed. The difficulty was accentuated by present conditions, which do not allow engineers—though all those who were approached were very willing to assist the Committee—to submit cases of depreciation in such an orderly fashion as would allow one to draw from them definite conclusions. Very little is so far known by way of statistical information as to meters that come under consideration. Therefore the only information we have gathered is restricted to meters that have been picked out haphazard. In most cases they are absolute breakdowns, because good ones are kept at work. Thus all the points that have been brought out, I think, more or less relate to individual cases. The business of the Committee will be in the future to try and obtain some information supported by statistical results, so that they may know exactly what the meter has gone through before it registers inaccurately or breaks down, and is sent in for repair. Another difficulty is that every meter that is sent in for repair has a history extending over varying periods of gas manufacture. During the years it has been used the gas may have changed—it has undoubtedly changed occasionally. Through periods of stress, breakdowns, and so on, momentarily it must have changed in many cases. Therefore it is not always easy to ascertain whether the composition of the gas as at present shown does really represent the average composition of the gas that has been going through an individual meter for (say) a period of ten or twelve years. That is one difficulty. We know for certain that changes have taken place the last two years—particularly where tar or oil washing has been introduced. Replying to Mr. Watson, of course, the reporter has to marshal his available results, practically being in judgment over makers and gas engineers; and the difficulty always is to apportion blame or praise justly. You can quite imagine—though I should not like to say there was not co-operation between engineers and makers from the beginning—there is bound to be always a certain difference of opinion. One section likes to blame the other, or

be absolved from blame itself. What we have to consider is the larger question, Are we to provide meters that will stand the action of the gas as it is made to-day, or are we to change the gas so that it will not hurt the meter that has been practically unaltered for many years, apart from minor developments it has gone through in the course of evolution? Probably, a golden mean will have to be found. I venture to think the quality of the gas has changed rather more than the meter. I have pointed out certain changes that have taken place in the quality of the leather. Changes in gas manufacture have occurred which may or may not influence the life of a meter. It is our business to find out to what extent they do injure the meters, and to what extent these causes can be removed without altering the composition or general quality of the gas, because, so far as I can see, there is nothing in this general quality that should hurt any well-constructed meter. Any traces of hurtful substances, are there in quantities which cannot even be detected by chemical analysis; but we have to consider that the meter acts in the course of its very long life—the guaranteed life is mostly five years—as a scrubber, and retains the small traces and accumulates them. In this way, the meter acts as a final scrubber for the works; and gas undertakings need not be afraid that any slur can be cast on the quality of the gas by the consumer, because, whatever impurities there may be, the meter sees to it they never reach the consumer. With regard to my reference to the American practice, I hope Mr. Thomas Glover's remarks will not be misundertood. I did not actually state that the leathers which I happened to see there and to examine were of better quality than those used in this country. But I wanted to point out that the meter makers in the United States have seen fit to get control over the manufacture of the article which is to them their raw material, and that this cannot but influence the quality of their wares in a beneficial way. I am glad to hear from Mr. Kendrick that the analysis put forward by Mr. Watson—of undertakings using solvents in their gas, and the relation to the unaccounted-for gas—does not apply to every works. I should not like to be too definite on the point; but I do not think the percentage of unaccounted-for gas can give a direct indication of the life of a meter. It is not exactly leakage from the meter that we are troubled with, but other things —particularly corrosion and attacks on diaphragms. Mr. Shoubridge's pious wish for a better substance to be used in diaphragms is one that has been expressed before. I think the meter makers will answer it by the old adage that "There's nothing like leather." I may say that attempts which have been made before now in producing fabrics for diaphragms which had no connection with leather have not been very successful.

Mr. Thomas Glover (Norwich): May I have a word? I have just glanced through the report, and listened carefully to the speakers. It occurs to me that those who have been investigating this matter have confined themselves almost entirely to deposits of liquids in meters; and no general conclusion appears to be given as to facts found in different towns where different practices are in vogue in regard to manufacture. But there is one other deteriorating influence, I fancy, that is making itself felt, and which does not appear to have come under Dr. Lessing's review. This is the presence of free oxygen in the gas. It is known that there is this free oxygen in many instances. Where 13,000 cubic feet to the ton, and so forth, is returned, it is possible that a little free oxygen is in the gas. I am told it has a very deteriorating effect on any iron substance it comes in contact with, including the somewhat flimsy things we call dry meters. The tin cases of dry meters are not so good as they used to be, and deterioration is likely to take place rapidly with tinned steel. We know that some steel is very corrodible indeed; and if you have free oxygen present, I think corrosion will take place rapidly. But, in addition to this, is it not time to take into consideration the entire construction of dry meters? We know that they are very lightly constructed, and put together with solder. In fact, the dry meter is a "box of tricks" very often; and I think it ought to be a piece of proper engineering, and not a bit of light clockwork put together in this way. Well, now you have the job in hand, to see if we can have a proper dry meter, made to stand the wear and tear we are going to put it to in the days to come.

Mr. J. W. Glover (Chelsea): Dr. Lessing has given us a comprehensive and suggestive report on preliminary work; but, as he points out, this is not sufficiently advanced to permit of definite conclusions being arrived at. I think myself that this is especially so as regards the leather used for the diaphragms of dry meters; and if I can do anything to assist the Committee in arriving at a conclusion, I shall be delighted to do it. Dr. Lessing saw at our works two three-light George Glover dry meters. They had been in use for twelve years, and both registered 1 per cent. fast. So I was satisfied the leathers were sound. On opening the meters, the leathers were found to be in perfectly good condition, and showing no signs of wear. I have at present at the works two of our meters which have come in for repair after being at work for seventeen years. One has diaphragms made of English bark-tanned skivers, and the other is fitted with the so-called "Persian" skin. I think it would be very instructive if Dr. Lessing would see the leathers removed from these meters and compare the two. I should like also to submit to him the "basils" we are using for the larger meters. Those we are getting at the moment are British tanned, and British dressed. Our chemist tells me that these British basils are much more free from acid than the sample of the American skin which Dr. Lessing was good enough to give me. In fact, it contains only about one-half as much. The darker colour of the skin, I am informed, is due to the mangrove bark used in America for tanning. My own impression is that, in general, the gas protects the leather, and keeps it moist; and, speaking for myself, I submit that the leather we are at present using gives most satisfactory results. It is tough, very close in the grain, and durable, and I should deprecate very much any change until after prolonged investigation and trial.

The report was adopted.

The New Office-Bearers.

The President: I have now to inform you of the result of the Scrutineers' report on the balloting list. The new President is Mr. Broadberry.

Mr. A. E. Broadberry (Tottenham): I have to acknowledge with thanks the very great honour you have done me in electing me your President for the ensuing year. The position is a very important one—particularly at the present time; and naturally I approach the duties with a considerable amount of diffidence. There are many difficulties to be encountered in carrying out the duties of your President as they ought to be carried out. The suggested re-organization of the industry must very materially affect the Institution in the near future; and it is a matter of such first-rate importance that it cannot be approached without very great anxiety. It is a thing that should not be rushed at hurriedly. Very careful thought and consideration are required; and this will add to the anxieties of the position. I shall, however, do all I can in the interests of the Institution; and I feel sure that in carrying out these duties I shall have the hearty support of all.

The President: It is understood, of course, that Mr. Samuel Glover now becomes Senior Vice-President of the Institution.

Mr. Samuel Glover (St. Helens): It seems to me that the Junior Vice-President "slides" into the position of Senior Vice-President in a natural sort of way. You will notice that I am doing the slide at the present time. I re-dedicate myself to your service.

The President: The new Junior Vice-President is Mr. Thomas Berridge.

Mr. Thomas Berridge (Leamington): I thank you very much indeed for the honour you have done me. No doubt you are all aware that you are bringing the Manager of a small works into a very high position. All I can say is he will do his level best.

The President: The other officers elected are:

Ordinary Members of Council.—Mr. F. W. Goodenough, of London; Mr. George Stevenson, of Long Eaton; Mr. Henry Kendrick, of Stretford; and Mr. John Foster, of Birmingham.

Auditors.—Mr. J. L. Chapman and Mr. E. W. Drew.

Hon. Secretary.—Mr. W. E. Price, of Hampton Wick.

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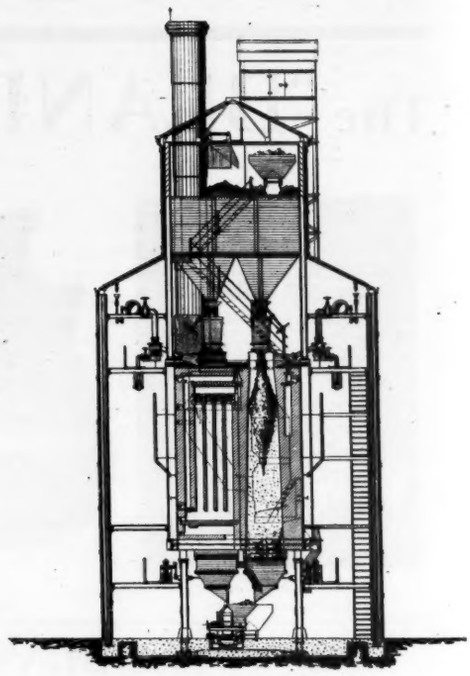

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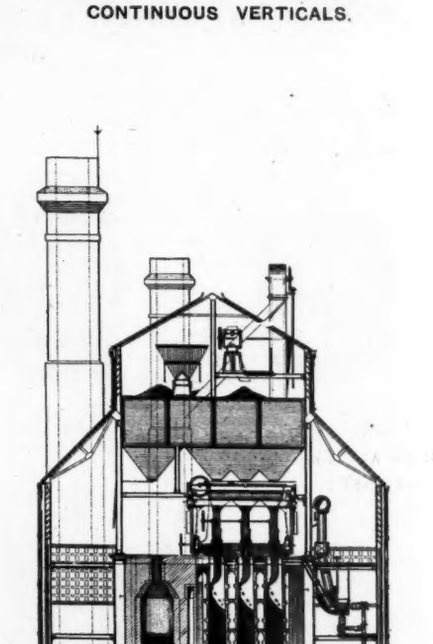

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New Members Elected.

The PRESIDENT: All the members and associate members on the balloting list have been elected—see p. 592.

Honorary Members.

The PRESIDENT: It now gives me great pleasure to move the election as honorary members of our esteemed colleague the President of the Société Technique du Gaz en France and Captain H. Riall Sankey, R.E. (ret.), M.Inst.C.E. I trust you will receive this proposition with acclamation. [Applause.] I take it these gentlemen are elected.

Place of Next Meeting.

The PRESIDENT: We now come to the place of meeting for next year.

Mr. BROADBERRY: None of us at the present time, of course, knows what the position of affairs will be this time next year when our annual meeting will take place; but I am sure you will all join with me in hoping that by then peace, if not already declared, will be so near at hand that we can have one of our usual meetings under normal conditions, and have an enjoyable time. I believe London is always popular as a meeting place with the majority of the members; and as the Company whom I have the honour to serve is a London Company, I certainly think that London would be a very suitable place to select for next year. I hope you will favour me by deciding on this.

The PRESIDENT: I have pleasure in seconding that.

Carried unanimously.

Votes of Thanks.

Mr. ALEX. WILSON (Glasgow): As a "Brother Scot," I have known our President for a very long time. The better I knew him, the more I liked him; and I think this has been the experience of his friends, and I am sure we can count among his friends all the members of the Institution. You heard to-day how well he has conducted the business of the Institution during the year he has been at the head of affairs. That is only what we expected. We thought he would do his best; and we knew his best was very good. We have had a test of him to-day in the chair; and I am sure the unanimous feeling will be that he has done excellently. I would, therefore, ask you to give a very hearty vote of thanks to Mr. Young, now he is quitting the chair, for his services during the year.

Mr. W. DOIG GIBB (London): As another "Brother Scot," I am very glad indeed to be afforded this opportunity of adding my tribute of praise to the excellent way in which our President has conducted the work of the year. I need say no more than that Mr. John Young, of Hull, represents all that is best in both man and master, and that we fully appreciate what he has done and will always do, I am sure, as long as he lives. He does everything well; and we thank him heartily.

The resolution having been formally put to the meeting, and carried with loud applause,

The PRESIDENT, in acknowledgment, said: I must thank the proposer and seconder most sincerely for the kind words they have spoken, and the members for so cordially receiving them. I am particularly gratified that these words should have come from "Brother Scots." It almost looks as though it was a "put-up job." [Laughter.] It is specially kind of Mr. Wilson to propose the vote, because, as he told me this morning, when you lay down the reins of President, you are going on the shelf, and as others come up you get pushed farther and farther along; and he is the one I have pushed off altogether. It has been a year of trial; but with the assistance given by everybody, it has not been so hard a year as I feared. Stress of circumstances has prevented me doing all I should have liked to do; but I have done everything possible, and if I have given satisfaction I am more than repaid. No one is better aware of my weaknesses than I am myself; and I thank you very much for the kind way you have overlooked them all.

Mr. W. N. WESTLAKE (Exeter): I propose that our thanks be given to the Institution of Civil Engineers for the facilities extended for this meeting.

Mr. H. E. BLOOR (York): I am pleased to second that.

The proposal was carried unanimously.

Mr. DOUGLAS H. HELPS (Reading): I beg to propose a vote of thanks to the Council and Hon. Secretary for their work in the past year.

Mr. J. H. TROUGHTON (Newmarket): I have pleasure in seconding that.

Mr. W. E. PRICE (Hampton Wick): It is rather hard that it should be put on me to reply, not only for myself, but for the Council whom I have endeavoured during the twelve months to control. You will know the difficulty I have had in so doing. But still, as I have had many things put on me, this is only one small incident; and I take it in the pleasant way I have endeavoured to take all other things that have been put upon me. On behalf of the Council, I thank you for your kind vote. We have had difficult times. We have been talked about from month to month, and, not only that, but also in print. We have not done those things we ought to have done, and we have done those things we ought not to have done. But still we have done our best. We have had many things to consider—matters which it has been necessary to take up to the highest quarters, to the Board of Trade and Ministry of Munitions, and they do not always run on the same path. Under these conditions, we have done what we could to uphold the interests of the industry we have so much at heart. As Honorary Secretary, also, I have to thank you for your vote. It has been a strenuous year; but the work has been a pleasure to me, and if it is your wish, as the balloting-list shows, that I should continue to work for the Institution and the industry I shall be happy to do so.

The PRESIDENT: Before I propose the next resolution, I would like to express my debt of gratitude to the Hon. Secretary. His guidance and the work that he has done have been absolutely invaluable to me in my year of office, and, above all, have enhanced a friendship of many years' standing. I have now to propose a hearty vote of thanks to Mr. Dunn. Mr. Dunn is like the brook—he goes on for ever. His work is continued all the time; and he is never at a loss. It never gets ahead of him. There is no work that is too much for him; no work that takes too long; no work that does not secure his best attention. Even the Council have very little idea of the assistance the Secretary is to the President and the Committees. It is very difficult to say anything new about him, because so many nice things have been said before; but I do wish to voice my appreciation of the great assistance he has rendered. During last month, a most interesting event took place in Mr. Dunn's life. He and Mrs. Dunn had the great felicity of completing twenty-five years of married life. Your Council took the opportunity of offering a small token of their respect and esteem in commemoration of the occasion, and I am sure your vote of thanks will be added to by the fact that you are congratulating him on such a happy event as his Silver Wedding.

Mr. PRICE: I will second that. Although the President knows a good deal of what Mr. Dunn does, I know more, because I have been in touch with him from day to day during the year; and what your President says is only a portion of what he should have said, if he had told you all that Mr. Dunn is to the Institution.

The vote having been heartily carried,

Mr. WALTER T. DUNN said: Allow me to remark how deeply gratified I feel for the kind words uttered in proposing and seconding the vote; also for the reference to the event I was able to celebrate recently, and the kindness of the Council in taking notice of it in the very gracious way they did. I intend going on working for the Institution and putting my whole heart into it; and you may depend upon me answering any call you may make. It is very pleasant to work with such appreciative friends. The Hon. Secretary is always of the greatest assistance.

Mr. W. R. HERRING (London): The vote of thanks which I have to propose is to the Research Committees, the Scrutineers, and the Auditors. If you will bear in mind that practically the whole of the day's proceedings has been the consideration of the reports of the Research Committees, you will have some idea of the amount of time that the members of these respective Committees must have devoted to the subjects they have taken in hand.

Mr. THOMAS HARDIE (Newcastle-upon-Tyne) seconded the vote, which was heartily accorded.

This brought the proceedings to a close.

THE BENEVOLENT FUND.

MEETING OF DONORS AND SUBSCRIBERS.

DURING the meeting of the Institution of Gas Engineers last Tuesday afternoon, the members resolved themselves for a time into the Annual General Meeting of the Benevolent Fund. The PRESIDENT (Mr. John Young) was in the chair.

The PRESIDENT: Gentlemen, I move that the minutes of the last annual meeting be taken as read, and approved.

Mr. W. E. PRICE (Hampton Wick) seconded this, and it was agreed to.

The PRESIDENT: I have now to move that the annual report of the Committee of Management and the accounts be taken as read and adopted.

Mr. W. W. WOODWARD (Salford) seconded this; and it was carried.

The PRESIDENT: Are there any observations on the report and accounts?

Mr. R. BEYNON (Torquay): What is the amount realized by the recent special appeal?

The PRESIDENT: I may tell you that the special appeal has resulted in a fairly satisfactory return. We have not got all the money that we wanted; but I have the pleasure to announce that a member from the North, who wishes to remain anonymous, has made a sporting offer that, if we are able to raise 75 per cent. of the amount required, he will provide the other 25 per cent. ["Hear, hear."] Now it is up to you, Gentlemen, to see that we get this 75 per cent., and more also, if it is possible. The Committee are very anxious about the future of the fund. The work, as you will have seen from the report, is an urgent one. Calls are answered to the greatest extent possible. The funds are safeguarded in every way. The cost of administration is very small. In fact, you may take it that the whole of the money goes to the objects for which it is raised; and I hope there will be a still further response to the appeal sent out. I want to tell you that we actually spent £6 8s. in postage; and a lot of envelopes with penny stamps on have not been returned. I shall be very glad if those members who have overlooked the fact that they have these envelopes and stamps belonging to the Benevolent Fund will kindly send them back, with some enclosure.

Mr. PRICE: If you will allow me, I should like to tell you something that has happened this morning. This question of the Benevolent Fund has been considered by the Committee; and going into the position of affairs, it was borne in upon your President that assistance is greatly required. He has therefore been very kindly moved to render this assistance; and, though his modesty will not allow him to refer to the matter, I will tell you about it. This morning, the President made a gift to the Benevolent Fund of £100. [Applause.]

Mr. SAMUEL GLOVER (St. Helens): As a member of the Fund Committee, I should like to explain that the very kind and timely gift of the President is to be invested—possibly in War Loan—as a permanent endowment of the fund; and it will only so far as the interest on it is concerned be available for addition to the funds at disposal. I explain this to any members who may think that the fund is already richly provided for by the very handsome grant of the President, which will, of course, be of permanent use to the fund. I would also like to clear away any doubt there may be in your minds with regard to the "sporting offer" made by an anonymous friend in the North. The 25 per cent. that is offered is 25 per cent. of the adverse balance that was due to the fund; and this 25 per cent. will be provided even if subscriptions to the fund are very largely over the amount required to balance the fund. So that gentlemen who want to subscribe to the fund need not entertain the idea that they will be reducing the offer of the sporting friend by subscribing liberally. We want to get the fund on a healthy foundation, so that there will be no holding-back from suitable cases the help that may be provided by means of the fund.

Mr. H. E. BLOOR (York): How much is this adverse balance?

The PRESIDENT: £63; that was the adverse balance on last year's account.

MR. BLOOR: And what is the amount represented by the 25 per cent. offer?

Mr. S. GLOVER: 25 per cent. of £63.

The PRESIDENT: Unless we get more help, the coming year will see a very large deficit. It is most necessary that annual subscriptions or donations—I should prefer annual subscriptions—should be secured, to enable the Committee to carry on their work to the end of the year.

Mr. WOODWARD: I should like to say a word. I think if we adopted rather different tactics, we should get every member to subscribe, even if in some cases the amount was only 5s. I think if we took each county separately and got some prominent man there to write to all these gentlemen, we should get at all events a small subscription from every member. I do not know what proportion at present subscribe; but I think there are many who do not. For a long time I myself did not—not because I was against the thing, but the papers as they came were put aside, and until the matter was personally brought to my notice I did not subscribe. However, I have now for many years subscribed, and have tried to do a little to reduce the adverse balance. As I have said, if we could appoint a man in each county to write personally to everyone, I think we should get all the members subscribing. I do not know whether such a scheme can be brought about; but I think the amount we subscribe is not worthy of the Institution.

Mr. W. G. S. CRANMER (Willenhall): How much have the District Associations provided towards meeting this adverse balance, and how much has the special appeal provided?

The PRESIDENT: The total net result of the appeal sent out is £56 odd. As I pointed out before, this will scarcely meet the adverse balance up to the end of last year; and we are anxious that we should be in a sound financial position for this year. You will have noticed from the annual report that the Committee will be very short indeed unless there is an increase in the income.

Mr. CRANMER: That includes about £40, I believe, of donations from the District Associations?

The PRESIDENT: We have six donations from the various Associations having nothing to do with the special appeal—the Eastern Counties, £10 10s.; the North of England, £10 10s.; the Southern District, £10 10s.; the Midland, £10 10s.; the Manchester, £10 10s.; and the Wales and Monmouthshire, £2 2s. The last named have sent an additional £2 2s. in answer to the special appeal.

The report and accounts were then adopted.

The PRESIDENT: I have to announce that the ballot for the election of two members of the Committee of Management, to succeed those who retire by rotation, has resulted in the appointment of Mr. J. Ferguson Bell, of Derby, and Mr. C. F. Botley, of Hastings. The meeting is now resolved into a special meeting for the purpose of appointing a Trustee in the place of the late Sir Corbet Woodall; and I have great pleasure in submitting to you the name of Mr. H. E. Jones, a gentleman who has been connected with the gas profession for very many years, and has been very generous not only to the Benevolent Fund, but also to the Institution. I am sure he would make a good Trustee.

Mr. JOHN BOND (Southport): I second that, and think Mr. Jones would be a very suitable man for the work.

The PRESIDENT: If there is no other nomination, I will put that to the meeting.

The resolution was carried unanimously; and the business of the meeting concluded.

REPORTS OF SPECIAL COMMITTEES

SUBMITTED AT THE ANNUAL MEETING OF THE INSTITUTION OF GAS ENGINEERS.

[*Ante* pp. 565-77.]

REPORT OF THE REFRACTORY MATERIALS RESEARCH COMMITTEE—YEAR 1915-16.

The work of the Committee has again suffered from the hindrances referred to in the report presented last year—viz., the absence of some members on military service and the preoccupation of others owing to stress of work caused by the war.

Steps are, however, being taken to ensure more active prosecution of research on important questions connected with the work of the Committee. This has been rendered possible by the grant of £130 for the Committee's work for the current year made by the Advisory Committee of the Privy Council for Scientific and Industrial Research—this contribution being supplementary to the two grants of £50 made by the Institution of Gas Engineers and the Society of British Gas Industries respectively.

During the year, Dr. J. W. Mellor has continued the work upon the behaviour of refractory materials under load. The preliminary results obtained on small samples made from typical fire-clays were detailed in the Committee's report of 1914; and, as announced in the report for 1915, these tests are being extended in larger apparatus capable of taking whole bricks. The work in this respect is still in progress, but is not sufficiently advanced for report. Dr. Mellor and Lieut. Moore have, however, by a further examination of the results of the first examination of small samples, succeeded in elucidating the general law of the relationship of refractoriness to load under the conditions prevailing in those tests. The details of this investigation are described in a paper by Dr. Mellor and Lieut. Moore, published in the "Transactions" of the English Ceramic Society; and the Committee recommend that this paper be reprinted in the "Transactions" of the Institution for the current year.

Work has also been commenced on the other subjects mentioned in last year's report—namely, on the difference in size of bricks when cold and when at high temperature, also on the cement material employed in retort-settings, and the effect of the addition to it of varying proportions of fine grog. But the time occupied in the designing, and especially in obtaining delivery of, the necessary apparatus has made it as yet impossible to carry the experiments sufficiently far to permit of any general conclusions.

The grant of £130 made by the Advisory Committee of the Privy Council for Scientific and Industrial Research has enabled the Committee to make a commencement of investigations on other important points as follows:

(*a*) The relative effect of an oxidizing and a reducing atmosphere on the refractoriness of fire-resisting goods.

(*b*) The influence of fine dust carried into the settings on the refractoriness and life of the materials employed.

(*c*) The effect of admixture of highly silicious rock (such as ganister) on the working qualities of fire-clay goods.

(*d*) The effect of firing temperature on the subsequent refractory qualities of the goods.

Up to the present, the only work possible on these matters has been the design and ordering of the necessary apparatus for carrying out the work; but it is hoped that sufficiently early delivery of the apparatus will be obtained to permit of report on the results next year.

Hitherto all experiments with full-sized bricks have been made on bricks which can be obtained in the open market, as to which there is no definite information available of the details of manufacture. The experiments have been useful; but the Committee have now authorized Dr. Mellor to have a number of bricks made of known materials, under known conditions, from different types of fire-clay and with varying proportions and varying sizes of grog. Tests of these bricks it is believed cannot fail to result in information valuable alike to the manufacturer and user.

A large number of tests of fire-clay material made since the introduction of the standard specification have been collated and recorded. The bearing of these results on the standard specification has been carefully considered; but it is not thought advisable, in the present state of knowledge, to make any alteration in the specification.

The last meeting of the Joint Refractory Materials Committee of the Institution and of the Society of British Gas Industries was held at the County Pottery Laboratory, Stoke-on-Trent; and the members of the Committee were afforded the much-appreciated opportunity of inspecting the work there in progress on their behalf by Dr. Mellor. They were joined by Alderman Elliott, the Chairman of the Stoke Education Committee, who are the controlling body of the County Pottery Laboratory; and in the unavoidable absence of the President of the Institution, the Chairman of the Refractory Materials Committee expressed to Alderman Elliott and to Dr. Mellor the hearty appreciation of the Committee and of the Institution of the invaluable assistance they had given in the work on refractory materials as especially affecting the gas industry.

During the absence of Major Bywater on Active Service, Mr. J. P. Leather has been appointed Acting Hon. Secretary of the Committee.

(Signed) HAROLD G. COLMAN, *Chairman.*
J. P. LEATHER, *Acting Hon. Sec.*

SUPPLEMENTARY REPORT ON THERMAL PHENOMENA IN CARBONIZATION.

BY

HAROLD HOLLINGS [Gas Research Fellow, 1912-1914]

AND

JOHN W. COBB (Livesey Professor).

[*Contributed from the Laboratory of the University of Leeds.*]

After our last report was presented to the Institution in 1914, some further experiments were made during the summer of that year, with the object of answering certain theoretical questions which had arisen; and in June, 1915, a paper was read before the Chemical Society* in which the results of these experiments were given. The general experimental method was exactly the same as that described in the 1914 report.

We had conceived it possible that the characteristics of the heating curve of a coal might be traced to the portions of coal separated by pyridine (or pyridine-chloroform) extractions, but such did not prove to be the case. There was a very close resemblance between the curves obtained for the portions of coal soluble and insoluble in pyridine. The prominent feature in common with the curve for the original coal was the exothermic stage noted above 600° C. Partial decomposition of the coal by the solvent, rather than a solution of one constituent, seemed to be indicated.

In order to trace the progressive changes in thermal phenomena on carbonization, which marked the transition from cellulose to hard coal, curves were obtained for different types of coal and for lignite, dehydrated cellulose, and cellulose itself.

The results obtained were instructive, and their co-ordination with such chemical data as are available leads to the following summary:

(1) *Below* 400° *C.*—Cellulose shows a strong exothermic reaction, commencing at 345°; but this is very much weakened in dehydrated cellulose and lignite, and absent in the coals. It is presumably connected with the loss of hydroxyl groups from cellulose, and consequent molecular condensation in the residue.

(2) *Between* 400° *C. and* 600° *C.*—In this interval, the characteristic differences of the types of coal are manifested. Oils, unsaturated hydrocarbons, higher paraffins, and oxygenated compounds are produced in quantity and quality dependent on the nature of the coal; and the thermal phenomena are varied in a corresponding degree.

* "Transactions of the Chemical Society," Vol. 107, pp. 1106 to 1115. See "JOURNAL" for Oct. 5, 1915, p. 24.

(3) *Between* 600° *C. and* 800° *C.*—In this interval methane is evolved, and all the coals display marked exothermicity in passing through it. If the carbonization of coal is on the whole exothermic, as is generally supposed, it seems likely that the principal factor in determining the exothermicity is operative in this interval, and that the main reaction responsible is the exothermic production of methane. This conclusion is supported by thermal calculations applied to hypothetical chemical equations for the carbonization of coal with and without the formation of methane.

(4) *Above* 800° *C.*—As clearly indicated by the experiments of Burgess and Wheeler,* and confirmed by Vignon,† hydrogen becomes the main product of distillation above 800°. The thermal change is equally marked around the same temperature. Above 800°, the process is either thermally neutral, or, more probably, slightly endothermic, presumably because the reactions producing hydrogen are themselves of that character.

(5) Thermal phenomena at low temperatures are only marked with cellulose and coals of a high oxygen content; while phenomena at high temperatures are most marked with anthracite and coals of a low oxygen content.

VENTILATION RESEARCH.

THIRD REPORT OF THE JOINT COMMITTEE OF THE INSTITUTION OF GAS ENGINEERS AND THE UNIVERSITY OF LEEDS.

The Committee consists of Messrs. John Bond, J. H. Brearley, E. W. Smith, and Charles Wood, of the Institution of Gas Engineers, in co-operation with Professors Arthur Smithells (Chairman), Julius B. Cohen, John W. Cobb, of the University of Leeds, Mr. G. R. Thompson, and Mr. William Harrison, Research Chemist.

In our second report, we gave the results of experiments which showed how much air a gas-fire could remove from a room under something like standard conditions, and we also showed that very much more could be moved if suitable auxiliary inlets were used.

A question which at once suggests itself is how far conditions in existing installations resemble those of our experiments. An adequate answer will require the systematic testing of a number of existing installations; but further laboratory investigation seemed advisable in some directions before proceeding to that very necessary part of our work. One condition has been mentioned as obviously essential for the best results with gas-fires—viz., that the necessary small draught must not be eliminated altogether by such an undesirable phenomenon as a back-draught, and an attempt has been made (we believe with some success) to throw some light upon the way in which a back-draught is brought into being, or at any rate encouraged, by certain conditions, some uncontrollable, such as the direction of the wind, others more or less controllable, such as the position of the chimney outlet relative to the roof and adjoining surfaces. The experiments are on the small scale, but give some definitely useful indications. They are detailed below.

There is also a question as to what degree of ventilation can be effected by burning gas not in a gas-fire but in a burner under a take-off pipe, whether the burner is used primarily for lighting or for ventilation. The ventilating power available per cubic foot of gas is much higher in such an apparatus than in a gas-fire, because a much smaller fraction of the total heat is radiated therefrom, and so much more is available in the hot products of combustion.

Ordinary gas-burners are not at present fitted to any form of ventilating shaft; but special ventilating burners are so fitted, and to one of these was given special attention (fig. 7). In this burner the products of combustion are gathered into a narrow tube *a b c* which is carried some way up the encircling main tube *d e f*. The narrow tube is supposed to act as an "injector," and the products of combustion passing up it and issuing at *g c* are supposed to exert such a suction in the annular space *c h* that more air and products of combustion in total enter the main flue *i* (and reach the outer air) than if the tube *a b c* were omitted and the gases simply passed into the tube *h e d*.

A similar arrangement has been claimed to increase the ventilating effect of a gas-fire; and it was thought desirable to subject the claim to actual trial. The simple and valid application of the injector principle is seen in a bunsen burner. Gas at some inches pressure issues from an aperture at a high velocity, depending on the initial pressure; and its travel being guided by the bunsen tube, it shares momentum with the contained air, and as the air is swept away in the direction of the tube, more air flows in from the side holes to take its place.

The gas pressure is here the dominant factor; and what makes the injection possible and useful is the conversion of the pressure head into directed velocity head. There is, however, little resemblance between such a system and the injector tube, whether of a ventilating burner or a fire, in which the tube is fed with products of combustion, and any local pressure differences inducing flow are of a minute order of magnitude—the high temperature, and consequent lightness, being the dominant motive force.

The details of the experimental investigation are given below; but we may say at once that no validity could be established for the use of the injector arrangement in either fire or burner.

It became evident on experimental examination of the ventilating burner which was put under test, that the size of the take-off pipe might have been increased with advantage. Probably this is realized, and there are limiting practical considerations; but it seemed to us that the time was ripe for us to place in the hands of gas engineers and others who were concerned with the same problems of design some definite results to indicate what ventilating effects could be secured by certain lengths and diameters of pipe with various gas consumptions—the gas being supposed to be burned under the pipe which was taking off the products of combustion. A large number of results were obtained, and tables were drawn up from them.

A curious phenomenon complicated results in the first set of experiments, inasmuch as the gas and air passing up the pipe were thrown into a state of vibration as in an organ pipe, and the flow was abnormal and unsteady. Lowering the flame a little—to 6 inches below the tube mouth, instead of 2 inches—remedied this state of affairs, and restored steady flow. The flame ceased to "blow" the organ pipe.

This is a brief initial summary of the objects to which our attention has been directed during the past year, and a detailed description of the experiments and their results is given below.

Down-Draught.

The conditions determining down-draught in practice are so obscure and complex that it was thought desirable to reduce the problem to its simplest form. A current of air of known velocity representing the wind was therefore sent across the top of a tube representing a chimney, and planes were set around the tube in various positions to represent roofs and walls. By altering the slope of the tube, the effect of a downward or an upward direction of the wind could be simulated; and in any experiment the resulting down-draught or up-draught in the tube could be easily detected. Such a draught would, of course, in practice, be superposed upon the normal draught in a flue, and might increase, lessen, extinguish, or even reverse it.

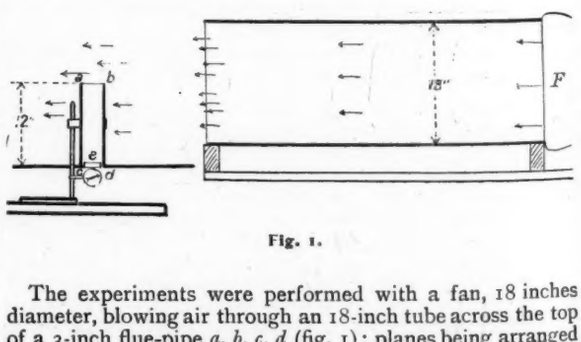

Fig. 1.

The experiments were performed with a fan, 18 inches diameter, blowing air through an 18-inch tube across the top of a 3-inch flue-pipe *a*, *b*, *c*, *d* (fig. 1); planes being arranged in different ways about the pipe. The direction and magnitude of the draught in the flue were determined by means of a wheel anemometer *e* (set within the pipe at its lower end), which rotated in one direction for up-draught, but indicated the existence of a down-draught at once by revolving in the opposite direction.

* "Transactions of the Chemical Society," 1910 (2), 1917, and 1911 (1), 619. See "JOURNAL" for Jan. 3, 1911, p. 25; also June 6, 1911, p. 667.

† "Comptes Rendus" 1912, 155, 1514. See JOURNAL" for Jan. 14, 1913, p. 107.

The first set of experiments was made by placing the flue at different angles to the direction of the current of air (fig. 2). When the angle θ was above 60°, up-draught resulted; but at angles below this, down-draught. The down-draught was increased by placing a second similar flue [see dotted lines] behind the first—in fact, any obstacle behind the flue increased the down-draught. This condition of a flue at an angle to the direction of air currents is often encountered, since the wind rarely moves in an exactly horizontal direction and very often moves downward, particularly after passing over an obstacle.

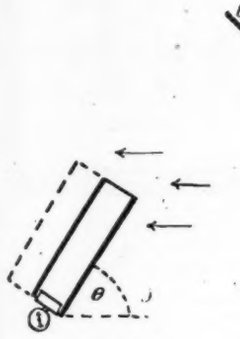

Fig. 2.

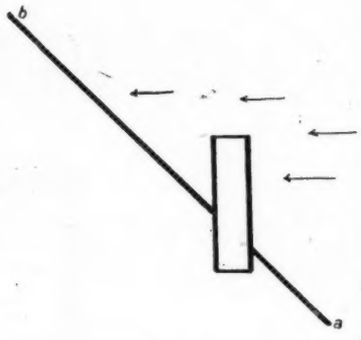

Fig. 3.

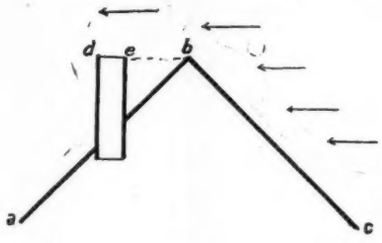

Fig. 4.

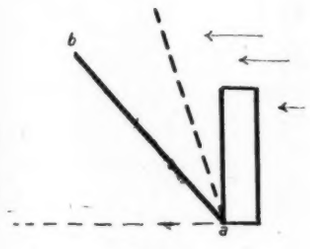

Fig. 5.

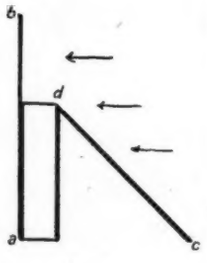

Fig. 6.

[The tube in figs. 2 to 6 is 12 inches long, 3 inches wide.]

The use of several chimneys of the same length, in close proximity, may cause a down-draught in the one which the wind meets first, since those behind it act as obstacles. This effect is increased if the chimneys are of different lengths and the wind meets the short ones first.

The second set of tests was made with a plane $a\ b$ (fig. 3), (representing a roof) placed at 45° to the flue; the air blowing on the same side of the plane as the flue was placed. The results showed that the up-draught produced was diminished as $a\ b$ was extended in the direction of b above the top of the flue, but no down-draught was produced.

The third set of experiments was made with two planes $a\ b$, $b\ c$ (fig. 4), placed to represent the roof of a house; the flue being on the side $a\ b$ opposite $b\ c$, on which the air was blowing. It was found that whenever the top $d\ e$ of the flue was in a position below the level of the top b of the planes, there resulted an up-draught smaller in amount than in the absence of the planes; but that when the top of the flue was gradually raised above the level of the top of the planes, the up-draught increased until it became the same as when no planes were used.

The up-draught produced when the top of the flue is below the level of the top of the planes follows on the preliminary action of the first plane $b\ c$ on the impinging air currents. This condition has already been the subject of investigation by Stanton.*

In the fourth set of tests a plane $a\ b$ was fixed at different angles behind the flue (fig. 5). No draught was given when the plane was inclined at 69° to the horizontal; the upper end b of the plane being then 7 inches higher than the top of the flue. Up-draught resulted from smaller and down-draught from greater angles of inclination.

With the plane $a\ b$ vertical, the down-draught was considerable, and the addition of a second plane $c\ d$ placed at 45° in front of the flue multiplied this down-draught three times (fig. 6).

Down-draught produced by obstacles behind the chimney is caused by increased static pressure from banking-up of the air, and so cannot be obviated by the use of any special form of chimney-cap. Thus, in practice, it is a common thing to see a flue pipe from a gas-fire or gas-stove fixed up the side of a house without extending to the lower level of the roof. Obviously, when the wind blows against the side of the house where the flue is placed, strong down-draught will be produced from an increase in pressure around the top of the flue; and this cannot be prevented by any form of cap placed on the flue. The only cure is to raise the flue considerably above the level of the roof. Many down-draughts are, however, preventible by any construction of chimney cap in which currents are deflected in a manner consistent with the indications of the experiments just described.

In dealing with the influence of winds on the chimney top, it is, of course, quite realized that other factors must enter into the result. Thus, it is plain that any suctional effect exercised on a door or window from causes analogous to those studied above would, by lowering the pressure at the bottom of any flue inside the room, tend to cause a down-draught.

Experiments on a Ventilating Burner with Injector.

The burner used has already been described, and is shown in fig. 7. In these experiments the opening into the room was altered gradually, as in previous experiments with gas-fires, and the quantity of air removed from the room by the burner under different conditions was determined. This quantity was deduced from the composition of the gases passing up the flue or from their temperature, both methods being employed at times. Analyses of the room atmosphere were also made, so as to determine under what conditions the products of combustion failed to be extracted by the burner flue.

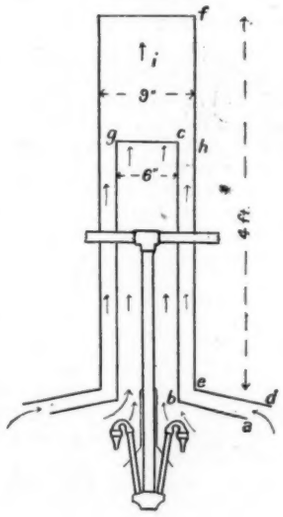

Fig. 7.

Further experiments were made on the same lines after removing the inner injector tube of the burner. The results are collected in Table I. They show that, with an opening of 144 square inches into the room, when the burner was taking 39 cubic feet of gas per hour (the full gas consumption), the air removed was 93·5 cubic feet per cubic foot of gas burned, but that when the injector tube was removed, this number rose to 143, indicating that the injector was not only useless, but was detrimental in its effect upon

* "Proceedings of the Institution of Civil Engineers," Vol. CLVI., 1903, and Vol. CLXXI., 1907.

ventilation—presumably because of its frictional resistance. When the gas burned was lowered to 11·5 cubic feet per hour, the ventilating effect rose still further, to 285 cubic feet per cubic foot of gas burned, showing that the take-off tube was really too small to be an efficient ventilator with the full gas consumption. This is more plainly shown below in experiments made on tubes of different sizes. There was no accumulation of CO_2 in the room until the inlet had been choked-down to 9 square inches; but below this, the rate of accumulation increased rapidly. The products of combustion were probably drawn down the annular space *c h* between the inner and outer tubes; but when the inner injector tube was removed, the tests showed distinctly that no accumulation of CO_2 occurred until the most extreme condition—a complete blocking of the air inlet—was attained.

TABLE I.

Conditions of Experiment.	Opening into Room. Square Inches.	Gas Rate. Cubic Feet Per Hour.	Volume Moved. Cubic Feet Per Hour.	Volume / Gas Rate.	CO_2 Added to Room Parts Per 10,000.	Time Taken in Accumulating Co_2. Hours. (*)
(Door open)	2200	37·6	3910	104	..	..
Ventilating	144	39·7	3700	93·5	..	..
Burner fig. 7 (†)	36	38·8	3240	..	..	..
	16	39·0	..	..	None	..
	9	38·5	2250	..	8	2½
	6·25	39·0	..	..	8	1
	4	39·0	..	..	20	¾
	None	38·4	1100	29	65	2½
Ventilating	144	41·5	5950	143	..	..
Burner fig. 7	9	40·0	..	..	None	2
Central or injector	4	40·0	..	..	None	2
Tube removed	2·25	40·0	..	..	·4	2
Ventilating burner	144	25·5	5070	198	..	..
Central or injector	144	28·6	5270	184	..	..
Tube removed	144	11·5	3260	285	..	..
Lower gas rates	..	..	..	..	..	..

* This column gives the time taken between starting the experiment under the specified conditions and drawing the gas sample for analysis.

† This burner was tested with a 4-foot length of 9-inch outer pipe *e f* (fig. 7); this being the greatest length which could be conveniently fitted in our experimental room. In practice, much longer tubes are used; and these would, of course, give a higher efficiency.

NOTE: In the tests made of the ventilating burner, the air moved (without injector) was 5950 cubic feet, with 41·5 cubic feet of gas per hour. The width of the tube was 9 inches and the length about 4 feet. If additional length was given to the tube, which is usually done in practice, the volume moved would be increased. For instance, with 9-feet length the volume moved would have been about 9300 cubic feet per hour.

GAS-FIRES AND THE INJECTOR PRINCIPLE.

The next set of experiments was made to determine how far the injector tube principle, proved invalid for the ventilating burner, was valid for the gas-fire. The numerical results are collected in Table II., to which reference will be made. An interesting initial comparison was made between the volumes of air moved up the main flue, in the first place burning the gas in a gas-fire with a vent of 17 square inches area and an auxiliary opening of 105 square inches, and, in the second place, burning the gas in a ring-burner in the main flue with the same auxiliary opening, and drawing air through the vent of the unlighted gas-fire. When the gas supplies were so adjusted that the temperature in the main flue was the same in the two cases, the volumes passing up the flue (determined by analysis) were also the same. This indicated that the head in the main flue resulting from the lower density of the hot gases was the moving force in both experiments, and that the velocity of the gases issuing from the vent of the lighted gas-fire in the first experiment had a negligible effect.

The actual volumes moved up the flue were 10,200 in the first experiment (Table II., Test 3) and 10,100 in the second experiment (Table II., Test 4).

A more direct test was made with a device arranged, as in fig. 8, to reproduce as nearly as possible a method of applying the injector principle to gas-fires which has been adopted in practice. Above the vent pipe *a b*, in this arrangement is fitted an air-duct *b c*, and the hot gases issuing from *a b* are supposed to draw air along the duct *b c* by "injector" action. The actual volumes moved per cubic foot of gas burned were 194 with the injector attachment (Table II., Test 9), and 222 without it, but allowing an auxiliary air opening of the same area (Table II., Test 10). These results show that, as far as ventilating effect is concerned, a special injector device of the type shown has no advantage over a simple thin plate opening into the flue; and, in fact, it has a slight disadvantage, because it adds resistance to the system. That the total area of opening into the main flue is the determining factor was also clearly shown by

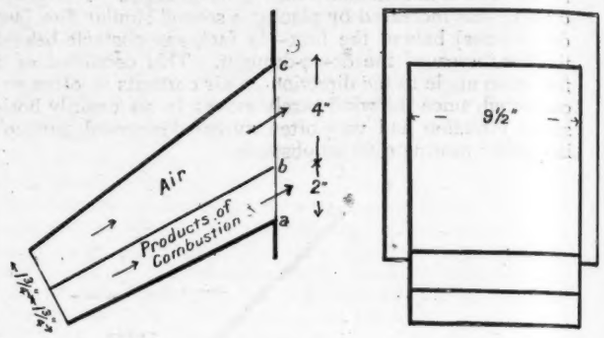

Fig. 8.

comparing a special gas-fire arranged in a register, provided with a large vent of 51 square inches area (fig. 9), with one in which an auxiliary opening was used to make up approximately the same total area of opening into the main flue. The results were approximately the same—see Table II. Nos. 6 and 8.

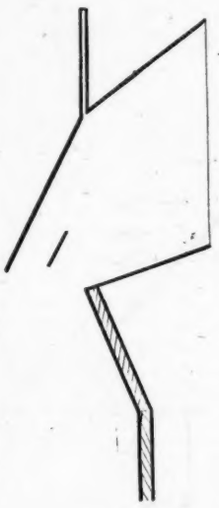

Fig. 9.

[1-10th full size.]

Fig. 10.

Fig. 11.

[In this drawing the scale is ¼-inch to the foot.]

A further experiment on the application of the injector principle to tubes conveying products of combustion was made in a very simple form. A tube 2 feet long and 3 inches in diameter was placed in the main flue (fig. 11), 12 inches square, of our testing-room; and the air moved up that flue by a ring-burner placed below the expanded mouth of the smaller tube was compared with the air moved by the same burner when the smaller injector tube was removed (fig. 10). The injector moved 670 cubic feet per foot of gas burned—see Table II., Test 12, and the simpler arrangement 725 cubic feet—see Table II., Test 11.

Summarizing, we have not found in any of our tests that the injector principle, as applied by leading products of combustion at nearly normal pressure along a narrow tube, with a view to their inducing a flow of air along an encircling or apposed air-duct, and so increasing the total volume moved has any validity.

VOLUMES OF AIR MOVED BY DIFFERENT CONSUMPTIONS OF GAS UP FLUES OF VARIOUS SIZES.

A large number of experiments has been carried out to determine the volume of air moved up flues of various sizes in order to obtain a means of fixing the relation between the quantity of gas burned and the size of flue, in a way sufficiently definite to serve as a basis for design in all forms of gas engineering apparatus in which the high temperature,

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TABLE II.

Description.	Flue Area. Sq. In.	Auxiliary Opening. Sq. In.	Gas Rate. Cub. Ft. per Hour.	Volume. Cub. Ft. per Hour.	Volume / Gas Rate.	Temp.* °C.
1. Fire No. 7 of second report.	16·8	..	24·0	4,090	170	40
2. With auxiliary opening in base of flue, 3 in. by 3 in. . .	17	9	23·6	5,380	224	..
3. Do., 11¾ in. by 9 in. .	17	105	24·0	10,200	425	21
4. Fire arranged as in No. 3, but burner placed in flue . .	17	105	13·5	10,100	748	21
5. With auxiliary opening above fire vent., 3 in. by 3 in.. . .	17	9	24·9	4,760	191	48·5
6. Do., 6 in. by 6 in. .	17	36	24·9	6,650	267	30
7. Do., 11¾ in. by 9 in. .	17	105	24·9	8,250	330	21
8. Fire No. 8 (compare with No. 6 above) .	51	..	23·1	6,330	274	29
9. With attachment as in fig. 8	17	17†	25·6	4,980	194	..
10. Interpolated for auxiliary opening of same area from 4, 5, and 6	17	17	24·9	5,300	222	..
11. Ring-burner in flue fig. 10.	105	..	12·5	9,050	725	19
12. Ring-burner with injector tube as in fig. 11.	105	..	12·5	8,400	670	23

* This is the excess of the temperature in the flue over that of the air entering the room.

† Area measured at lower end of attachment—fig. 8.

and consequent lightness of products of combustion, is used as a means of moving air. The flues used were 4½, 6, 9, and 12 inches in diameter, 36, 70, and 106 inches long, and were fixed in the ceiling of the experimental room. In all experiments the opening into the room was 12 inches square, which offered inappreciable resistance compared with that of the 4½-inch and 6-inch tubes, but had a considerable influence when using a 12-inch tube; about 25 per cent. less being moved than when the door was left wide open.

The first set of tests was made with the three different lengths of 4½-inch flue pipe; the volumes moved were determined by analysis and also deduced from temperature measurements. The ring-burner used was fixed in the first instance 2 inches below the base of the flue, but, presumably because the entering air impinged on the column ascending from the flame, the resonance to which reference has already been made resulted, with consequent irregularities. The importance of not placing burners too near a flue-pipe taking off the products of combustion if maximum and regular flow is desired was so demonstrated at the outset.

The experiments were repeated with the burner placed lower—from 4 to 6 inches below the flue—so as to avoid resonance. Under these conditions the results were more regular, and a fair agreement was secured between the figures determined by chemical analysis and by temperature observation. It was, however, not found possible to obtain absolute agreement either between results obtained by the two methods, or between numerous analyses made under apparently identical conditions, and it soon became apparent that quite as much reliance could be placed on the figures obtained directly from temperature measurement as upon those resulting from analysis. The most practical method of obtaining results which suggested itself was to increase the number of readings as much as possible, which could be done most easily by the temperature method; this was adopted. Although the heat lost by radiation and conduction increases as the temperature rises, the effect on the results derived from temperature measurements is to a large extent balanced by the fact that the change in the volume of air moved produced by a change in the available heat, decreases as the temperature rises. At any rate, the agreement obtained between the two methods was sufficient to show that the effect of loss of heat was not great in comparison with other sources of error.

It is intended at some future time to repeat these tests by utilizing a form of electric meter which has already been designed to measure directly the air entering into the room through a 12-inch opening.

Curves (figs. 12, 13, and 14) were constructed by plotting the experimental figures for temperature difference (between the air inside and outside the flue) and gas-rate; and tables were drawn-out from these. [See Tables III. and IV.] No account was taken of the effect of the pressure-head of the gas used, since it was not found possible to determine this with certainty.

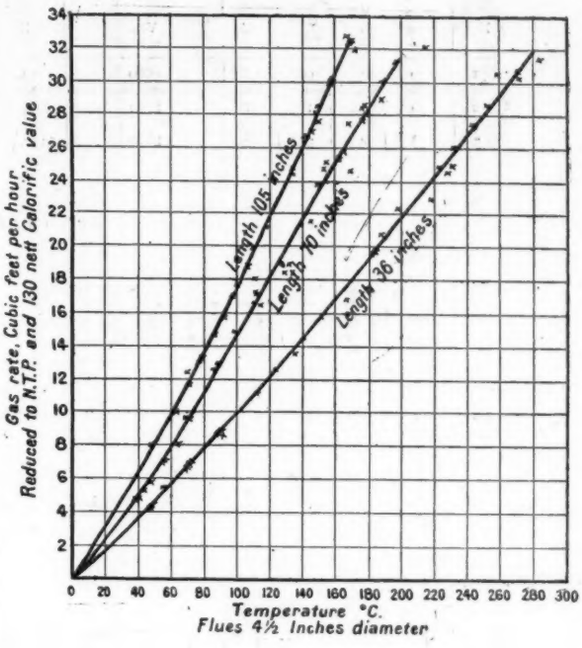
Gas rate. Cubic feet per hour. Reduced to N.T.P. and 130 nett Calorific value
Length 105 inches
Length 70 inches
Length 36 inches
Temperature °C.
Flues 4½ Inches diameter

Fig. 12.

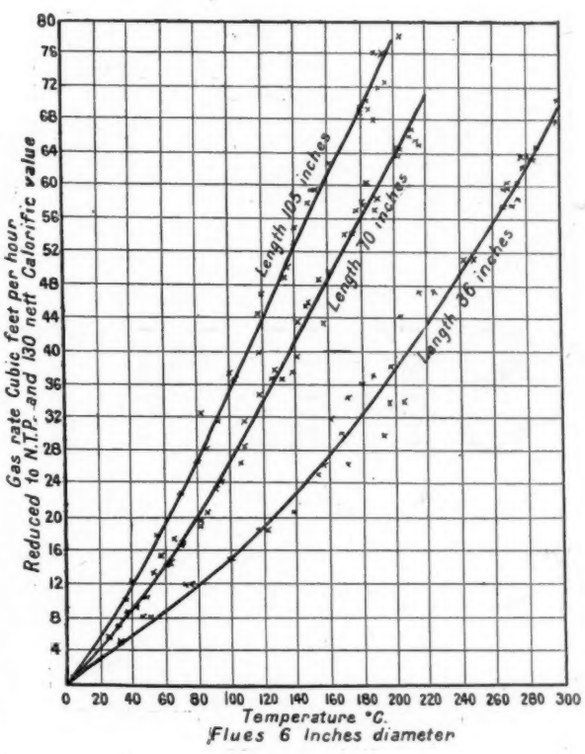
Gas rate Cubic feet per hour. Reduced to N.T.P. and 130 nett Calorific value
Length 105 inches
Length 70 inches
Length 36 inches
Temperature °C.
Flues 6 Inches diameter

Fig. 13.

Gas rates were reduced to the equivalent of gas having a net calorific value of 130. It is clear that if this reduction were not made, the ratio of air moved to gas rate would decrease as the calorific value decreased.

With the 3 feet length of 6-inch pipe the results were very variable, since the conditions within the tube were easily disturbed by movements in the neighbouring air—see lowest curve of fig. 13. It appears from this and other results that the ratio of length to diameter should not be below a certain minimum—say, 6—if steady flow is to result. Peclet's simple formula for flow in a vertical tube,

TABLE III.

Diameter, inches	4½	4½	4½	6	6	6	9	12
Length, inches	36	70	106	36	70	106	106	106

No.	Temperature °C	Vol. Gas Rate.	Gas Rate.	Vol.	Gas Rate.	Vol.	Gas Rate.	Vol.	Gas Rate.	Vol.	Gas Rate.	Vol.	Gas Rate.	Vol.	Gas Rate.	Vol.	Gas Rate.	Vol.
1	10	1510	0·7	1060	1·1	1660	1·5	2260	1·4	2120	2·1	3170	2·8	4230	4·0	6,050	7	10,600
2	20	755	1·6	1210	2·4	1820	3·2	2420	2·9	2190	4·5	5400	6·0	4530	9·5	7,170	16	12,100
3	38	400	3·4	1360	4·6	1860	6·1	2440	5·6	2240	8·6	3440	11·6	4640	19	7,600	34	13,600
4	40	377	3·7	1390	5·0	1880	6·5	2450	6·0	2260	9·2	3460	12·4	4670	21	8,400	36·5	13,780
5	50	300	4·7	1410	6·4	1920	8·2	2460	7·5	2265	11·8	3540	15·9	4780	28	9,120	47	14,100
6	60	250	5·8	1450	7·9	1980	9·9	2480	9·1	2270	14·4	3600	19·6	4900	36·5	9,400	58	14,500
7	75	200	7·3	1460	10·1	2020	12·5	2500	11·4	2280	18·5	3700	25·0	5000	47	9,620	78	15,600
8	80	187	7·9	1480	11·0	2060	13·5	2520	12·2	2280	20·2	3780	27·2	5090	52	10,420	85	15,900
9	100	149	10·1	1500	14·4	2140	17·6	2620	15·4	2300	27·0	4030	35·6	5300	70	10,550	118	17,600
10	110	136	11·1	1510	16·0	2180	19·6	2670	17·1	2330	30·4	4130	39·5	5370	78	10,850	138	19,800
11	120	124	12·3	1520	17·9	2220	21·8	2700	19·0	2360	34·0	4240	44·0	5450	87·5	11,450	—	—
12	140	106	14·6	1550	21·4	2270	26·0	2770	23·2	2460	41·3	4360	52·4	5550	108	11,700	—	—
13	150	100	15·6	1560	23·2	2320	28·1	2810	25·2	2520	44·5	4450	56·0	5600	117	12,000	—	—
14	160	93	16·9	1570	25·2	2340	30·5	2840	27·6	2560	48·6	4540	61·0	5670	129	12,300	—	—
15	180	82	19·3	1580	28·5	2340	—	—	32·4	2660	56·0	4600	69·6	5720	150	11,950	—	—
16	200	74	21·9	1620	—	—	—	—	37·6	2780	63·4	4680	78·0	5770	175	—	—	—
17	220	67	24·5	1640	—	—	—	—	43·2	2890	—	—	—	—	—	—	—	—
18	240	61	27·0	1650	—	—	—	—	49·1	3010	—	—	—	—	—	—	—	—
19	260	57	—	—	—	—	—	—	55·4	3150	—	—	—	—	—	—	—	—
20	280	52	—	—	—	—	—	—	62·0	3220	—	—	—	—	—	—	—	—
21	300	49	—	—	—	—	—	—	69·0	3360	—	—	—	—	—	—	—	—

Gas rate in cubic feet per hour reduced to 0° C. and 760 mm. pressure and 130 net calorific value in K.C.U. per cubic foot = 490 B.T.U. per cubic foot at 30 inches pressure and 60° F.

Vol. = Volume of gases per hour moved up flue in cubic feet at 0° C. and 760 mm. pressure.
To convert cubic feet at 0° C. and 760 mm. pressure to cubic feet at 60° F. and 30 in. pressure, multiply by 1·053.
The figures below the black lines lie within the range of the experiments.

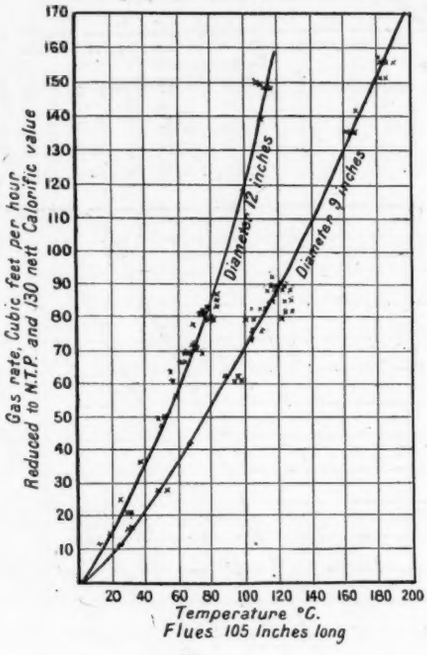
Gas rate, Cubic feet per hour Reduced to N.T.P. and 130 nett Calorific value
Diameter 12 inches
Diameter 9 inches
Temperature °C.
Flues 105 Inches long

Fig. 14.

to which reference has already been made in our second report, is :

$$M = 0.67A \times 1.3 \times \frac{273}{273 + T} \sqrt{\frac{2gL\,(T - t)}{273 + t}}$$

M = Mass moved in kilos per second.
A = Area in square metres.
L = Length in metres.
g = Gravity = 9·81 metres per second.
T = Temperature in flue pipe.
t = Temperature of outer air.

For a typical case—say, a 6-inch pipe 6 feet long, with a temperature difference of 100° C.—the volume in cubic feet per hour moved up the flue according to this formula would be 3730. The actual result from Table III. was 4030; and this required the consumption of 27 cubic feet of gas per hour. The difference between the observed and calculated values is thus about 8 per cent. in this case; but it is not the same with other conditions in the flue.

According to Peclet's formula, the maximum flow would be reached with a temperature of 273° C. in the tube, the air outside being at 0° C. In the results given in our second report the maximum was shown between 120° and 180° for a 3-inch pipe. For the same length of 4½-inch pipe the maximum is apparently at a higher temperature, and again higher with the 6-inch pipe. For tubes of the same diameter, the temperature giving maximum result apparently becomes lower as the length of tube increases. The actual results come nearer to those calculated from Peclet's

TABLE IV.

Diameter of Pipe.	4½ Inches.		4½ Inches.		4½ Inches.		6 Inches.		6 Inches.		6 Inches.		9 Inches.		12 Inches.	
Length of Pipe.	36 Inches.		70 Inches.		106 Inches.		36 Inches.		70 Inches.		106 Inches.		106 Inches.		106 Inches.	
— Gas Rate.	Vol.	Vol. / Gas Rate.	Vol.	Vol. / Gas Rate.	Vol.	Vol. / Gas Rate.	Vol.	Vol. / Gas Rate.	Vol.	Vol. / Gas Rate.	Vol.	Vol. / Gas Rate.	Vol.	Vol. / Gas Rate.	Vol.	Vol. / Gas Rate.
1 . . 5	1420	285	1900	380	2220	444	2050	410	3050	610	4150	830	6,000	1200	8,500	1700
2 . . 10	1495	149	2030	203	2470	247	2270	227	3480	348	4570	457	7,200	720	10,800	1080
3 . . 20	1610	80	2260	113	2670	134	2380	119	3740	187	5000	250	7,800	390	12,600	630
4 . . 30	1660	55	2340	78	2850	95	2620	87	4150	138	5150	172	9,000	300	13,300	443
5 . . 40	—	—	—	—	—	—	2840	71	4350	109	5350	134	9,250	231	13,900	348
6 . . 50	—	—	—	—	—	—	3040	61	4550	91	5500	110	9,600	192	14,200	284
7 . . 60	—	—	—	—	—	—	3190	53	4650	77	5700	95	10,100	168	14,700	245
8 . . 70	—	—	—	—	—	—	3380	48	4650	66	5720	82	10,450	148	15,000	214
9 . . 80	—	—	—	—	—	—	—	—	—	—	—	—	10,550	132	15,600	195
10 . . 90	—	—	—	—	—	—	—	—	—	—	—	—	10,900	121	16,100	179
11 . . 100	—	—	—	—	—	—	—	—	—	—	—	—	11,200	112	16,600	166
12 . . 110	—	—	—	—	—	—	—	—	—	—	—	—	11,500	105	17,100	155
13 . . 120	—	—	—	—	—	—	—	—	—	—	—	—	11,750	98	17,700	147
14 . . 130	—	—	—	—	—	—	—	—	—	—	—	—	12,000	92	18,350	141
15 . . 140	—	—	—	—	—	—	—	—	—	—	—	—	12,150	87	19,000	136
16 . . 150	—	—	—	—	—	—	—	—	—	—	—	—	12,300	82	19,500	130

Gas rate in cubic feet reduced to 0° C. and 760 mm. pressure and 130 net calorific value in K.C.U. per cubic foot (= 490 B.T.U. per cubic foot measured at 60° F. and 30 in. pressure).

Vol = Volume of gases moved up flue in cubic feet at 0° C. and 760 mm.
To convert cubic feet at 0° C. and 760 mm. pressure to cubic feet at 60° F. and 30 in. pressure, multiply by 1·053.
The figures below the black lines lie within the range of the experiments.

formula as the diameter of the pipe increases and the length decreases.

In a formula given by Weisbach and Heermann,* another factor is introduced, thus:

$$M = 1{\cdot}3 \times A \times \frac{273}{273 + T} \times \sqrt{\frac{2gL(T-t)}{273+t}\left(1 + \frac{rL}{d} + R\right)}$$

Where

r = coefficient of friction of the air on the pipe
d = diameter of flue pipe
R = sum of all the other resistances in the system

Other letters have the same meaning as in Peclet's formula above.

The new factor under the root sign is $\left(1 + \frac{rL}{d} + R,\right)$ and since in most of our experiments R = O, this becomes $\left(1 + \frac{rL}{d}\right)$

Our experimental results are not in agreement with the introduction of this factor, although the friction of air on the pipe and the relative dimensions must affect the results to some extent.

Comparing the figures for the various tubes, it will be seen that the volume moved up a 6-inch tube is more than four times that moved up a 3-inch tube of the same length, at the same temperature—most probably because the circumference, and therefore the skin friction, does not increase so rapidly as the area.

The results of these experiments with flue pipes afford a means of fixing the relation between the length and area of the pipe and the amount of gas which can be burned to give an efficient ventilation. Since the ratio of air moved to gas consumption diminishes gradually as the gas-rate increases, it is impossible to fix an optimum gas-rate. It is, however, convenient to fix a certain desired ratio of air moved to gas burned and tabulate the conditions of securing that ratio. Choosing ratios of 100, 200, and 300, the amount of gas required for pipes of different lengths and diameters within certain limits is given in Table III., lines 5, 7, and 13.

With a flue temperature of 150° C. above that of the outer air, the ratio of air moved to gas burned is 100; and although more exact figures should be taken from the tables, it may be said that at any ratio below this a proportion of the gas is being consumed with little or no ventilating effect. As the ratio rises, the effectiveness of each cubic foot of gas for ventilating purposes increases. The curve in fig. 15 was constructed by plotting the temperature difference between the gases in the flue and the air outside, horizontally against the ratio $\frac{\text{volume moved}}{\text{gas rate}}$ vertically.

Table IV. has been constructed to show what can be done with various gas consumptions according to the sizes of pipe used, and the curve (fig. 16) to show the relation between the gas-rate and the ratio $\frac{\text{volume moved}}{\text{gas-rate}}$ for the different tubes. As examples of the practical applications of the results in the tables, the following are given.

Suppose a lighting burner, burning 30 cubic feet of gas of 130 net calorific value per hour, were available for ventilating purposes, what size of pipe would be required to make efficient use of this heat? From the table it will be seen that 9 feet of 6-inch pipe only gives a ratio of 172; but 9 feet of 9-inch pipe gives a ratio of 300, and 9 feet of 12-inch pipe a ratio of 443 cubic feet gases per cubic foot gas burned.

Taking smaller dimensions—say, of a burner consuming 5 cubic feet per hour—the volumes moved with tubes of various dimensions and the relative ventilating effect can be obtained directly from the first line in Table IV. A 4½-inch pipe, 70 inches long, gives a ratio of 380 cubic feet of gases per cubic foot of gas burned.

In the tests made of the ventilating burner (Table I.) the air moved (without injector) was 5950 cubic feet with 41·5 cubic feet of gas per hour. The width of the tube was 9 inches and the length about 4 feet. If additional length was given to the tube, which is usually done in practice, the volume moved would be increased. For instance, with a 9-feet length the volume moved would have been about 9300 cubic feet per hour.

Since a ratio of 400 cubic feet per cubic foot of gas burned can be secured with a gas-fire and suitable auxiliary opening, and since a much larger percentage of the total heat is available for ventilating purposes with a burner than with a fire, the ratio 400 does not seem unreasonable as an immediate practical objective. For a gas consumption of 40 cubic feet per hour it would be attained by the use of a tube 12 inches in diameter and about 12 ft. 6 in. long.

* "Mechanics of Air Machinery," p. 5 (1905); Crosby Lockwood and Son.

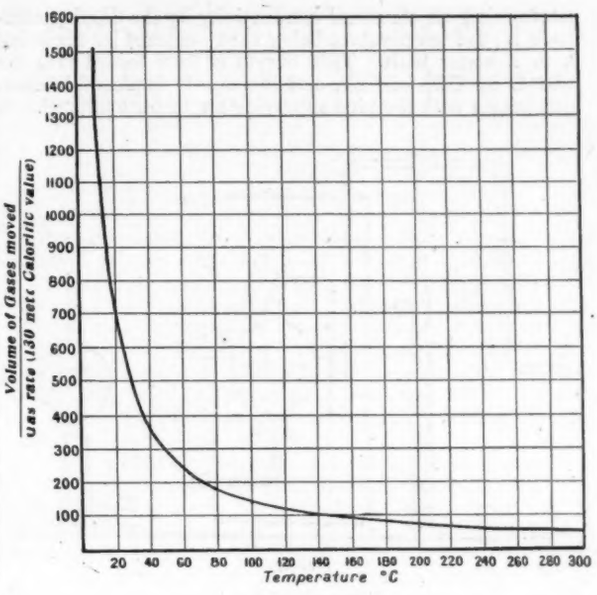

Fig. 15.

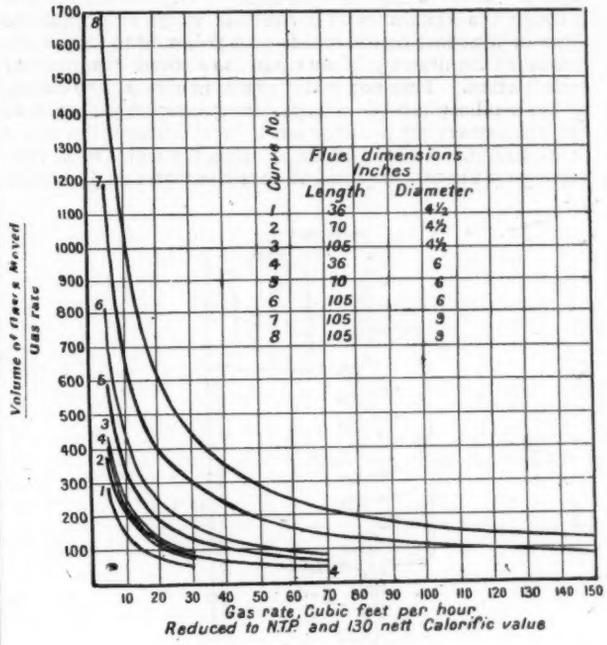

Fig. 16.

Methods of Analysis.

The methods of analysis used in this work have had to be carefully considered; and the following notes thereon may be of interest. For determining rapidly the percentage of CO_2 which would result from the combustion of a particular sample of coal gas, a modified form of Hempel apparatus has been designed. This is shown in fig. 17. The modification consists in the addition of a graduated pipette P, to be used with mercury in place of the ordinary burette. The quantity of gas to be analyzed is measured under atmospheric pressure in the pipette P, transferred to the explosion bulb B, and exploded with an excess of air. The products are drawn into an evacuated bottle, and the CO_2 determined by the barium hydrate method.

The electrical apparatus mentioned in the first report has been modified considerably to enable determinations of CO_2 in air to be made. The apparatus is shown in fig. 18. The method employed consists in running 50 c.c. of standard baryta into the bulb A (about 100 c.c. capacity) and

determining its electrical conductivity by the dipping electrode B; the temperature being kept constant by enclosing A in a water bath. This baryta is then forced into the tube C by CO_2-free air, and the tap D is placed in communication with the pipe supplying air to be analyzed. A

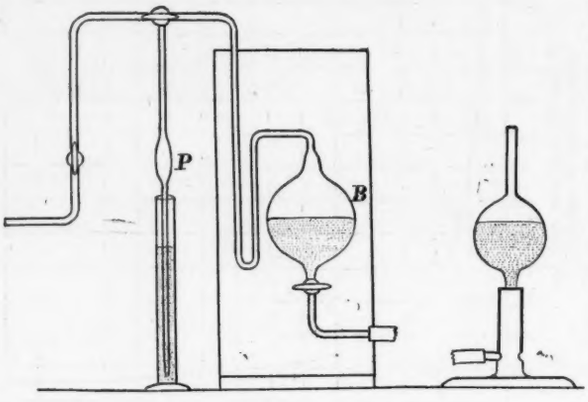

Fig. 17.

[One-sixth full size.]

known volume of air—usually about 1 litre—is then drawn through the apparatus at a constant speed by a modified form of Marriott bottle, which was designed to stop automatically the drawing of air when the desired quantity had been passed. This automatic action is obtained by means of the capillary tube G, which, during sampling, is open to the air, preserving a difference in level between the water in E and F. So soon as F is filled, the water rises very rapidly up the capillary and at once destroys this difference

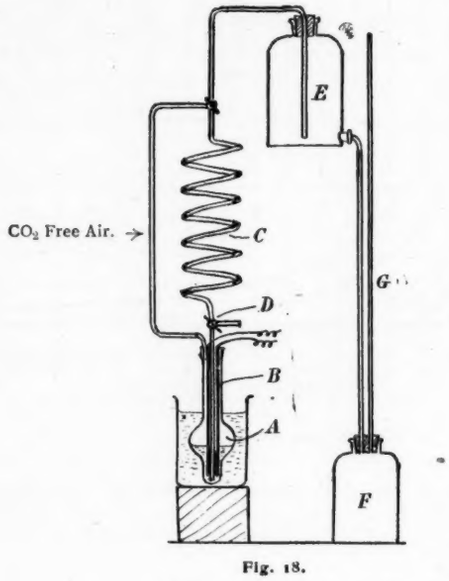

Fig. 18.

[About one-tenth full size.]

in level. The capacities of E and F depend on the volume of air required for analysis.

After absorption, the baryta solution is forced back into A, and mixed up by bubbling CO_2-free air through the solution. The conductivity is then re-determined, and the difference between this and the previous determination gives a measure of the amount of CO_2 absorbed. The baryta may be used several times.

In order to secure accuracy, it is necessary to determine the conductivity by comparison with a standard of small capacity and small inductance.

The form of this apparatus described in our first report is useful for gases containing more than 1 per cent of CO_2, while the second form, just described, is useful for air analysis, and may possibly be modified to form a portable apparatus for this purpose.

LIFE OF GAS-METERS RESEARCH.

PRELIMINARY REPORT OF THE JOINT COMMITTEE OF THE INSTITUTION OF GAS ENGINEERS AND THE SOCIETY OF BRITISH GAS INDUSTRIES.

The Joint Committee appointed by the Institution and the Society of British Gas Industries in October, 1914, to investigate the various conditions affecting the life of gas-meters consisted of Messrs. Edward Allen, John Bond, A. E. Broadberry, Samuel Glover, W. E. Price, R. G. Shadbolt, Sir Corbet Woodall, and Mr. John Young, representing the Institution, and Messrs. T. A. Braddock, J. W. Broadhead, F. G. Cockey, F. Templer Depree, J. William Glover, Thomas Glover, Joseph Hepworth, and W. H. Johnston representing the Socety. The Committee greatly regret to record the deaths of Sir Corbet Woodall, Mr. Allen, and Mr. Hepworth.

A Sub-Committee, consisting of Messrs. Broadberry, Price, Young, Cockey, T. Glover, and J. W. Glover, was appointed, and a number of meetings have been held.

The Committee, in submitting the following preliminary report, which has been prepared by Dr. R. Lessing (their Chemist), are of opinion that the inquiry will have to be carried to a much greater length before any definite conclusion can be arrived at. The work is necessarily of a costly nature, but the inquiry, as far as it has proceeded, has made it evident that valuable results will be obtained.

The Committee are anxious to collect all available information relating to the subject, and ask for the co-operation of members of the Institution in the directions which are indicated in the report. It will be of great advantage in ascertaining the effects on meters of gases of various composition if members will assist by carrying out tests at those works and districts where the required conditions exist.

Dr. Lessing's Report.

Gentlemen,—I have pleasure in submitting to you my report on the work carried out during the past year under the auspices of your Committee. In doing so, I should like to point out that the work is not sufficiently advanced to permit of definite conclusions being drawn, nor even to settle certain questions of fact. Progress was somewhat impeded by factors dependent on war conditions—such as the difficulty in obtaining as much assistance from engineers and manufacturers as would have been given willingly under normal conditions. The purely analytical work could not be advanced as rapidly as I should have wished, on account of the depletion of my staff by enlistment.

The terms of reference submitted to me for inquiry were the following:

I. Effects of position of meters when in use.
II. Liquids in meters.
III. Action of gas upon meters.
IV. Decay of leather.
V. Internal corrosion.
VI. Deposit on valve-faces.
VII. Naphthalene in meters.
VIII. In a given time, is more work being put on meters than heretofore?

I was permitted to report progress from time to time at meetings of your Sub-Committee, and wish to acknowledge gratefully the valuable assistance given to me by members of this Sub-Committee.

So far the inquiry has been restricted to the examination of "dry" meters, which, if not exclusively used, are the more important in point of numbers in most districts. At the same time, the question of wet meters, which are still extensively used in certain districts, has been kept well in mind. It is anticipated that some of the results obtained with dry meters can be directly applied to wet meters, while, on the other hand, the absence of certain materials of construction—such as leather and oil—from wet meters may simplify the elucidation of some factors by an examination of the latter.

The material for the investigation consisted partly of information given by meter makers and gas engineers. A number of visits have been paid to the works of meter manufacturers and to meter repair departments of gas companies.

A great number of meter liquids have been supplied both by meter makers and engineers. In order to have authoritative samples of the materials employed in meter manu-

facture, makers were invited by a circular-letter to supply the following samples:

1.—Oil or oil mixture as used for dressing diaphragm leathers.
2.—Blacklead as used for mixing with oil dressing.
3.—Cuttings of leather as used for diaphragms.
4.—Cord or wire, tape, and glue, as used in fixing diaphragm leathers.
5.—Tinplate as used for discs and cases.

In all, 160 samples of meter liquids and materials have been submitted, and a good deal of valuable information has been given. For the reasons specified above, the examination of all samples has not yet been completed; work being restricted to the more important items.

A trip to the United States, which I had occasion to undertake early this year, gave me an opportunity of getting in touch with American engineers and manufacturers, and obtaining valuable information on their experiences. The troubles which are being met with in this country as regards the life of gas-meters do not seem to be apparent in America at the present time, although such troubles did exist some ten or fifteen years ago. I hope to find some explanation of the difference in conditions obtaining here and across the Atlantic by an examination of a number of meter liquids and samples of meter parts which have been supplied to me by some important meter makers in the States. I should like to express my grateful appreciation for the courtesies and assistance extended to me by the gentlemen and firms concerned.

From information given to me by engineers and makers, it appears that the factor which contributed more than any other to the improvement in the conditions was the formation of a combine of the most important firms of meter makers for the purpose of standardizing and centralizing the manufacture of meter parts. They were thereby enabled to have one factory attending to the manufacture of all mechanical parts, and to run their own tannery for the purpose of making diaphragm leathers only. This latter point appears to be of great importance, since British meter makers are, for the purchase of diaphragm leathers, almost entirely in the hands of foreign and colonial tanners, who are not cognizant of the requirements of this special application of leather, but supply a general market.

I.—Effects of Position of Meters when in Use.

The difficulties attaching to the solution of this question are obvious; and in the absence of statistical information and of the complete history of a great number of meters, fixed in typical positions, it is exceedingly difficult to draw definite conclusions. It is, therefore, necessary to settle the question experimentally. I have arranged with several engineers to carry out experiments by placing duplicate sets of meters under cover and out of doors, in order to obtain comparative results. Owing to the pressure of war work, and other reasons specified below, it was not considered advisable to press these experiments at the moment. However, even in the absence of experimental evidence there cannot be any doubt that the position of the meters below the supply mains, and in exposed areas, passages, or out of doors generally, will promote condensation in, and general deterioration of, the meters.

From the occasional observations of a great number of meters, it was found that the position of the meter does not appear to afford any clue to the amount of condensation or deposition of liquids which might be expected in a meter. Indeed, it has been found that the quantity of liquid in the front and back compartments of a meter differed considerably; and so far no rule could be observed which would indicate that this was due to a difference in average temperature between the compartments, of which one might be exposed to currents of air from which the other is protected by the wall against which the meter is fixed.

II.—Liquids in Meters.

The deposition of liquids in meters appears to be the chief factor affecting the life of meters detrimentally. The mere fact of the presence of liquid in the meter case or inside the diaphragm will, in certain instances, influence the accuracy of measurement and registration. But of much more importance is the chemical and physical action of the liquid deposits upon the interior of the meters during and after their formation.

The deposition of liquids may be due to several causes:

(*a*) Condensation by cooling.
(*b*) Mechanical deposition of liquid particles by friction.
(*c*) The scrubbing action of the oil used for dressing the diaphragm leathers upon the constituents of gas soluble in oil.
(*d*) Actual flow of liquid into the meter.

The investigation of the formation of the deposits must proceed in two main directions. Firstly, deposition may be brought about experimentally by subjecting coal gas to the conditions above specified. This line of research will be found necessary in any case in order to obtain definite proof of any deductions made from the analytical results. Secondly, the liquids obtained from meters having been in actual use may be collected and chemically examined with a view to elucidating these causes by ascertaining the constituents and their combination.

It is manifest that experiments designed to expose coal gas to all the conditions which prevail in gas-meters must be of a very complex nature; and the best course will be to select individual factors and examine their influence experimentally.

Among the components of commercial town gas which are likely to be arrested in meters by one of the above-mentioned causes are: Condensible hydrocarbons, organic sulphur compounds, tar fog, oil fog, water, dust (of various composition), to which must be added compounds such as ammonia, hydrogen sulphide, or cyanogen, which may combine chemically with the materials used in the construction of the meters or with the deposits already introduced into the meter.

The difficulty of arranging experiments for this purpose at the present time is that the conditions of scrubbing and "cleaning" (as distinct from "purifying") the gas have been considerably modified since the war, and in most cases the gas would not be typical of that supplied during the years in which the bulk of the deposits in meters had been formed. At the same time, it is to be expected that the present-day practice of removing some of the aromatic hydrocarbons from the gas by scrubbing it with oil or tar will lead to a much better understanding of the conditions by which the condensation and solubility of the vaporous constituents of coal gas are governed.

With a view to studying these conditions I have constructed an apparatus for the estimation of condensible vapours in the gas in a simple way, which is being used not only for the purpose of isolating these hydrocarbons and other compounds from the gas, but also for comparing oils, and particularly the oils and oil mixtures employed in dressing diaphragm leathers, as regards their capacity for extracting these compounds from the gas. It is conceivable, and indeed very probable, that the various vegetable, animal, and mineral oils used in compounding the leather dressings vary considerably in their solvent power.

It is also essential that a method should be devised for the ready estimation of suspended particles in gas, particularly in tar fog and oil globules introduced for enrichment purposes, or as naphthalene solvents. Some preliminary work has been done in this direction; but the method used requires further elaboration, so as to standardize its results, and make them quantitative and reasonably accurate.

In the meantime, valuable assistance could be given by gas engineers and their distributing staffs making arrangements for the observation of individual meters of typical make and reasonable size—say, 5-light—from the moment of fixing them to that of sending them for repair. It would be particularly desirable if the liquors from each meter could be collected, or at least measured, separately at the earliest possible opportunity, and before the meter has been subjected to any change from its upright position. By comparing the quantities—and, if possible, composition—of liquors obtained from meters in similar and different localities, and under known conditions of fixing, distance from works, age, &c., valuable information could be gained.

If any such large scheme of testing is impossible at the moment, a limited number of meters should be fixed at suitable points in a district, and gas should be passed through them at their maximum capacity (possibly at regular intervals in order to reproduce the conditions of rest as in ordinary use); the idea being to get to the end of the "life" of the meter in a very short time—say, a few months. The

meters should then be carefully opened and examined in detail.

Analytical Examination of Meter Liquids.

In the absence of such experimental evidence, a good deal of attention has been given to the examination of meter liquids from various sources. In most cases very scanty information, if any, as to the previous history of the meters could be obtained. The specimens so far examined served largely for working out methods of analysis and indicating the lines upon which their investigation should proceed. Samples sent in were collected by the staff of meter makers or gas undertakings. In future, systematic sampling is urgently required, in order to preserve the ratio of oily and aqueous deposits in the meter.

In the early stages of this inquiry considerable difficulties were encountered in the analytical examination of these liquids. Distillation without the employment of steam proved almost impossible in many cases, owing to violent priming over. Steam distillation, on the other hand, interfered with the examination of the aqueous layer to a certain extent. This tendency to boiling over is due to the presence of very persistent emulsions in the liquids. I believe I have discovered the cause of this emulsification, and, as I shall show later on, this cause has a very important bearing on the "life" of the meter.

Volatile Hydrocarbons.—In the first instance, the amount and kind of volatile hydrocarbons in a number of meter liquids from different towns was ascertained—representing material unquestionably derived from the gas; the oil dressing of the diaphragms being non-volatile under the conditions selected. 1000 c.c. of liquid were distilled with superheated steam, until naphthalene ceased to come over. The distillates were then carefully fractionated several times. Finally, the following fractions were obtained from four different liquids:

	A.	B.	C.	D.	
Below 100° C.	0·8	1·1	1·2	1·2	per cent. by volume.
100° to 150° C.	10·0	7·5	11·6	7·0	,, ,,
150° to 175° C.	10·3	4·4	5·9	4·8	,, ,,
175° to 200° C.	11·9	5·7	12·1	4·2	,, ,,
Above 200° C.	lost	19·1	17·4	15·4	,, ,,
		38·0	48·2	32·6	per cent. by volume.
Naphthalene (not included in above)		5·6	9·3	7·7	grammes per 100 c.c.

The distillates, and particularly the lower fractions, had a most offensive smell, which is characteristic of the contents of gas-meters. Although the compounds causing this smell may not have any detrimental action upon metals or leather, their isolation appeared to be interesting, and was also expedient in order to make work with these fractions not too unpleasant.

The malodorous compounds were suspected to be mercaptans or similar sulphur compounds. The fractions were, therefore, treated with an alcoholic solution of mercuric chloride in the hope of forming mercaptides or other mercury compounds. The addition of mercury salt solution produced in every case a white, grey, or brownish precipitate, and effected the absolute removal of the malodorous compounds. The mercury compounds have not yet been investigated. The following quantities were found in the various fractions. It will be noted that the stronger smell of the lower fractions corresponds with the larger proportion of mercury compounds.

Mercury Compounds.

	A.	B.	C.	D.	
Below 150° C.	3·90	3·79	1·51	1·63	grammes per 100 c.c.
150° to 175° C.	1·83	1·36	0·42	0·71	,, ,,
175° to 200° C.	0·18	0·40	0·18	0·04	,, ,,

Paraffins.—After the treatment with mercuric chloride the proportion of paraffins to aromatic hydrocarbons was examined with the following results:

	A.	B.	C.	D.	
Below 150° C.	38·0	4·0	2·0	10·0	per cent. of fractions.
150° to 175° C.	12·0	<1·0	<1·0	<1·0	,, ,,
175° to 200° C.	2·0	<1·0	<1·0	<1·0	,, ,,

As a special method had to be worked out, great reliance should not be placed on these figures, most of which are probably on the low side. At the same time, the tendency of the paraffin ratio can be gathered from the figures; and it is worthy of note that liquid "A" comes from a district which, according to the statement of several makers, gives considerable trouble.

Non-Volatile Residues.—The examination of the non-volatile residues from the steam distillation was mainly directed to ascertaining the kind and percentage of glycerides—such as almond, peach kernel, or other oils—of which it was supposed these residues largely consisted. In the many saponification, extraction, and other tests some compounds always interfered with the isolation of pure fatty acids. It was found that the oily residues contained appreciable quantities of metals, particularly iron. On testing a larger number of liquors, it was shown that they all yielded an ash containing iron and some tin. This fact partly explains the tendency to emulsification by the formation of metal soaps. However, a portion of the metal contents was found to be present simply in suspension.

This led to a modified form of analysis, by which all liquors were first roughly separated into an oily and aqueous layer, and both were then filtered. Filtration becomes impeded by emulsions, both in the oily and particularly in the liquid layers. These emulsions contain a large portion of the iron and tin in suspension. Upon drying the emulsion or on evaporating the aqueous layer of the liquor, a dark brown substance is obtained, smelling strongly of leather, particularly on incineration.

The substance contains nitrogen, and appears to be a decomposition product of leather substance (collagen). It forms a colloidal solution in the aqueous deposit, from which it can be precipitated by electrolytes (notably by the salts of heavy metals), and is redissolved by water, forming a brown solution. It is probably even more responsible for the emulsification of the liquors than the metallic compounds of iron or tin.

The only method of dealing with the emulsions effectively proved to be centrifuging at very high speeds. The leather substance, still containing some oil and metallic compounds, is thereby thrown out, and can be separated from oil and aqueous liquor. Such mechanical separation of oil, aqueous solution, and solid matter is necessary before a complete analysis of the meter liquids can be attempted.

The proportion of oily to aqueous layer was determined in all cases; but the figures are doubtful, as no special care had been taken in the collection of the samples to preserve this ratio. No definite rule could be traced as to the preponderance of either layer. It must be remarked that it is often difficult even for the trained observer to distinguish the layers by the eye, as they are mostly very similar in appearance.

Inorganic Constituents.—A number of meter liquids have been examined for metallic and other inorganic constituents. Iron and tin are invariably present. Their distribution over the oily and aqueous portions was determined where possible, and it appears that the latter yields ashes richer in iron and the former ashes richer in tin.

The following figures show the distribution of total ash over the components of three typical liquids:

	E.	F.	G.	
Ash in oil	12·82	47·44	86·12	per cent.
Ash in aqueous solution	80·34	4·09	0·44	,,
Ash in emulsion	2·70	15·24	10·04	,,
Ash in heavy precipitate	4·14	33·23	3·39	,,
Total ash	100·00	100·00	100·00	,,

The ashes in the various portions contain tin and iron; the former in amounts varying from 8·0 to 33·8 per cent. Among other compounds found in meter liquids are: Ammonia, cyanide, prussian blue, thiocyanates, sulphates, chlorides, lead, lime, and others of minor importance. Their quantitative estimation has been done in some cases, and is proceeding in others. The results are not recorded here, as the amounts of liquids from each meter were unknown.

Source of Impurities.—Hydrocarbons, sulphur compounds, water, ammonia, and cyanogen compounds are entirely derived from the gas; iron, tin, and lead from the metal parts of the meter; lime, sulphate, and some chloride from the leather. The bulk of the chloride for which neither the gas nor the leather can account is probably due to hydrochloric acid and fluxes, such as ammonium chloride or zinc chloride used in the soldering process. Some iron may be extracted from the graphite in the diaphragm dressings—all samples of which were found to contain appreciable quantities.

A number of samples of graphite (black lead) obtained

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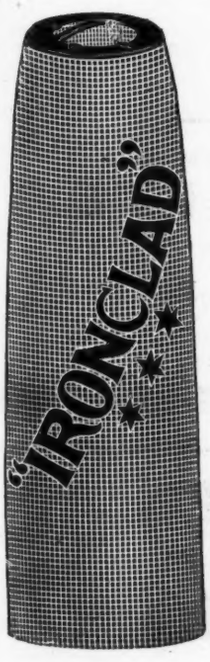

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from meter makers were tested for total ash and iron. The results are recorded in the following table:

No.	Ash in Sample.	Iron (Fe) in Sample.	Iron in Ash.
	Per Cent.	Per Cent.	Per Cent.
1	14·92	2·46	16·49
2	22·00	1·42	6·46
3	25·80	1·52	5·89
4	25·88	1·52	5·87
5	26·32	1·71	6·51
6	28·92	2·94	10·17
7	35·72	3·32	9·30
8	37·90	4·27	11·27
9	40·40	2·65	6·56
10	41·12	5·12	12·45
11	44·76	3·39	8·69
12	70·80	4·64	6·55
13	80·88	4·45	5·50

The amounts of iron found do not account for that found in the liquids, which must, therefore, be due to corrosion of the tinplate. But the percentage of ash in most samples of graphite (blacklead) are excessive. As the ash is a measure of the hardness, attention should be paid to the quality of the graphite used, as only the softest varieties will give the desired lubricating effects, while hard and gritty specimens are apt to injure the leather fibre mechanically.

Oils Used for Dressings.—The only tests made so far of oils received were those for viscosities at 32°, 60°, and 90° Fahr., in the Redwood No. 1 viscometer. Most samples were too viscous to be tested in this instrument at freezing point.

No.	Outflow in Seconds at		
	32° Fahr.	60° Fahr.	90° Fahr.
1	802	372	191
2	1244	400	220
3	1181	411	225
4	..	412	226
5	..	415	231
6	..	615	204
7	..	2065	579
8	..	2743	642
9	..	3688	372

III.—Action of Gas upon Meters.

The evidence supplied by the analysis of meter liquids leaves little room for doubt that ordinary town gas has a very considerable action upon meters. The liquids are formed in the first instance by the deposition of hydrocarbons, which are carried into the meters by the gas in the form of vapour or liquid, and by condensation of the moisture contained in the gas. They are sometimes augmented by liquid deposits previously formed in mains and service-pipes, which are accidentally allowed to discharge into the meter from a higher level.

The deposition of hydrocarbons and moisture is probably due to the following causes:

(*a*) Actual condensation of hydrocarbons.
(*b*) Scrubbing action of oil in diaphragms, and of other hydrocarbons already deposited.
(*c*) Arrest by friction of tar fog and oil globules in the tortuous passages of the meter.
(*d*) Condensation of moisture.
(*e*) Chemical combination of water with hygroscopic salts already deposited or present in the new meter (such as traces of zinc chloride, ammonium chloride, or hydrochloric acid, used for soldering.
(*f*) Combination of acid or other corrosive constituents of the gas with the materials employed in meter construction.

It would be feasible to reconstruct the probable course of action from these factors; but it is preferable to rely on actual experiments in this direction. The analytical examination of a great number of meter liquids so far carried out leaves, however, little doubt that most of above causes are at work during the use of a dry meter. The action of the hydrocarbons influences leather decay, as shown under the next heading. The moisture, and particularly the acid constituents of the gas, is principally responsible for the corrosion of the metal parts of the meter.

The presence of cyanogen compounds has been proved in practically all cases. Hydrogen sulphide has been found in some, and all liquids contained ammonia—some of them in fairly large quantities. The percentages of total ammonia, free and fixed, were very considerable—in some cases approaching 1 gramme of NH_3 per 100 c.c. of aqueous liquor (4·61 "oz. strength" liquor). Whether present in the free state, or in the form of ammonium salts, these compounds are bound to have a corrosive influence upon the metal parts of the meter, and equally so upon the leather diaphragm.

Chlorides have been found in some cases; it is not conceivable that this should have been brought to the meter by the gas; and it is more probable that it is due to the acid and fluxes used in the soldering process. It is not unlikely that the thiocyanate which is present in practically all meter liquids is due to the interaction of ammonia with carbon bisulphide in the gas, or else dissolved in the meter liquid.

The large amounts of tin and iron which have been found in all liquids bear witness to the action of the gas upon the meter case. The impurities mentioned may be (probably are) present in the gas from well-conducted works in extremely minute traces, which could not be readily estimated by ordinary analysis. But the meter acts as a most efficient scrubber and retains such traces, so that they assume, in the course of time, fairly considerable proportions, while the gas thereby undergoes a final cleansing before it reaches the consumer. This is done at the expense of the life of the meter. In certain cases, it has been found that companies who largely suffer from an excessive number of "repair meters" admitted upon inquiry that they were actually short of scrubbing capacity.

The action of the acids or ammonium salts upon the metal parts of the meter is accentuated by the fact that the tin coating will be sufficiently porous to allow them to reach the line of contact between tin and iron or steel; the two metals together with the inevitable moisture forming a galvanic couple. Similar conditions prevail at the joints where tin and zinc are in contact. In order to prove the point involved, it is highly desirable to undertake an extensive series of corrosion experiments by exposing all the materials which go to make up a gas-meter, particularly tinplate, leather, and oils, to the action of all the substances likely to be injurious which occur in ordinary purified town gas. These experiments should be supplemented by tests on finished meters with the same gas completely and incompletely freed from cyanogen, hydrogen sulphide, and ammonia.

IV.—Decay of Leather.

The discovery of hide substance in meter liquors proves conclusively that some decay of leather does take place, although in many cases this action may not go far enough to destroy the leather completely, but may permit of its further use after redressing. There cannot be any doubt that the degradation of leather substance must impair considerably the durability and mechanical resistance of the diaphragm.

The examination of diaphragm leathers which have been used for some time shows that in places some of the oil dressing is removed by the solvent action of the condensates, particularly in the lower portions.

The reasons for dressing diaphragms with mixtures of oil and blacklead are presumably:

(*a*) To render them impermeable to gas.
(*b*) To protect them from chemical action.
(*c*) To lubricate the leather fibre and thereby make the diaphragms pliable enough for their mechanical work.

Any chemical action upon the leather is preceded by the washing out from it of:

(*a*) The oil dressing and blacklead used by the meter maker.
(*b*) The oil used by the tanner.
(*c*) The natural grease in the hide.

By the removal of the oil from various sources the leather is dried and made brittle, and is consequently apt to leak. Once the protective coating has been removed, the leather is open to attack by the injurious constituents of the gas.

In this connection, reference must be made to the extensive report upon leathers used for book-binding by a Committee of the Royal Society of Arts published in 1901. The detrimental action of small traces of acids and also of ammonia upon leather have been proved beyond doubt by

this Committee. It is highly probable that traces of acids, ammonia, and other impurities in the gas bring about a similar decay.

This report also stated that leathers used for book-binding purposes contained some quantities of acid, probably sulphuric acid, used for improving the colour. It deplores the increasing use of mineral acids for brightening the colour to the detriment and durability of the leather, and recommends certain less harmful organic acids in their place.

I have analyzed a number of the leather samples obtained from meter makers and tanners for their acid contents. It is a peculiar coincidence that the acid percentage agrees almost exactly with the minimum and maximum found by the Society of Arts Committee.

Acid in Leathers used for Diaphragms.

No.	Acid in Terms of H_2SO_4
1	0·54 per cent.
2	0·58 ,, ,,
3	0·64 ,, ,,
4	0·69 ,, ,,
5	0·74 ,, ,,
6	0·76 ,, ,,
7	0·76 ,, ,,
8	0·78 ,, ,,
9	0·86 ,, ,,
10	0·91 ,, ,,
11	0·91 ,, ,,
12	0·92 ,, ,,
13	0·92 ,, ,,
14	0·93 ,, ,,
15	0·98 ,, ,,
16	1·00 ,, ,,
17	1·26 ,, ,,
18	1·37 ,, ,,
Average	0·86 ,, ,,
19 (Shavings)	0·70 ,, ,,
20 (Buffings)	0·85 ,, ,,
21 (After thirteen years' use)	1·87 ,, ,,

Most leathers used by meter makers are tanned in India and Persia; and buyers in this country have no control over the methods employed. They are manufactured largely to meet the requirements for book-binding and art leather, in which appearance and capacity for taking dyes are essential. Since colour is quite immaterial in connection with meter diaphragms, it seems a pity that acid should be introduced for improving it. It is worthy of note that the sample showing the lowest percentage of acid is an American leather specially tanned for gas-meter purposes. It is of a darker and less even colour than the skins used in this country, which are prepared along with leathers for other purposes.

It might be interesting to record a test of a diaphragm leather after use which still gives 0·94 per cent. of acid in terms of H_2SO_4 calculated on the dressed leather, or 1·87 per cent. calculated upon the dry leather from which the dressing has been extracted. It will be seen that the acid in the dry leather has probably increased during the use of the meter, although it may have been wholly or partially neutralized by ammonia. Other sources of acid, such as free fatty acids, in the oil employed have not yet been investigated.

V.—Internal Corrosion.

The results so far obtained under this heading have been discussed under Nos. II. and III. There is no doubt that corrosion of the tinplate takes place. If, as I believe, the impurities in the gas are responsible for this, it is conceivable that they diffuse through the minute pores of the tin coating and set up corrosion at the point of contact of iron and tin. It must be pointed out that water vapour in the gas will act very injuriously and induce or promote corrosion both before and after condensation.

A certain amount of internal corrosion in the meter case takes place with storing repair meters in open yards without sufficiently closing the inlet and outlet. The presence of moist air in the meter will also harden the leather when it is no longer protected by immersion in the gas. Repair meters should, therefore, be stored under cover, and all connections should be soundly closed by corks or screw-taps.

VI.—Deposit on Valve Faces.

Although a few tests have been made under this heading, there is not much to report, as some difficulty was found in obtaining a sufficient number of used valves for examination. It is generally assumed that these deposits consist of tarry matter carried forward in the form of fog. I have been able to prove the presence of organic matter in every case; but I also found that a large portion of the deposit—particularly along the edges of the valve covers—contained tin and antimony, which are the main constituents of the valve alloy. There is a possibility that this is due to dust left behind after grinding. However, the fact that the faces have lost their brightness and show signs of wear, and that the metal is well coated with organic matter, leads me to suspect that metallic corrosion and mechanical erosion attacks the valves under certain conditions. I understand that in some cases the valves give a good deal of trouble through sticking, and cause loss of gas through being lifted off their seatings. Some makers state that their valves give no such trouble. This does not disprove the assumption of metallic corrosion, as no doubt various alloys differ considerably in their resistance to chemical attack and friction.

VII.—Naphthalene in Meters.

All the meter liquids so far examined contain some naphthalene in solution or suspension. In some cases naphthalene is deposited in the passages of the meters and in the corners of the case and valve chamber. Apart from the mechanical trouble of actual stoppage, I do not believe that naphthalene is more injurious than other hydrocarbons; but as it is certainly very liable to deposition, it may form a nucleus for further condensation and scrubbing action. The greater difficulty in connection with naphthalene is that indirectly introduced by the use of solvents, both at the works and in the cleaning of service-pipes in the immediate vicinity of the meter inlet. The hydrocarbons thus sprayed into the system are bound to reach the meter and add to the liquid deposit.

VIII.—In a Given Time, is More Work being Put on Meters than Heretofore?

This is a question for solution by statistics; but it seems obvious that the answer is in the affirmative. As the factors promoting corrosion of metals, decay of leather, &c., are accumulating at the rate of passage of gas, it would appear that meters are bound to be affected by the quantity of gas passed through them in a given time.

The increased use of gas for heating purposes throws more work upon the individual meter, which is, in many cases, driven to the limit of, or beyond, the capacity for which it was originally designed. Overworking the meter causes the moving parts to be worn out sooner, or may put a strain upon them which leads to a complete breakdown. The extra load is further augmented by the deposition of liquid giving rise to greater friction.

Considerations Submitted.

Without venturing as yet a definite reply to the question why the deterioration of meters should have increased during the last decade, the following considerations are submitted as a basis for discussion and further investigation.

Substances of a corrosive nature have been found in gas-meters after use. Some acid is present in new diaphragm leathers, and some acid or chlorides may be introduced by the tinsmith. The bulk of the remaining injurious impurities—and more particularly cyanogen, ammonia, and hydrocarbons—pass into the meter with the gas.

As regards cyanogen, its formation has been promoted by the employment of higher carbonizing temperatures. Coinciding with this change, the abolition of lime purification has probably resulted in a less complete retention of the last traces of acid constituents of coal gas. It may be argued that, with ample purifier capacity, oxide of iron should be quite capable of removing these impurities as completely, if not as readily, as lime. The chances are, however, that the rapid increase in gas consumption of late years has necessitated in many works a more intensified utilization of the available scrubbing and purifying plant, allowing less margin for the removal of such traces, which are apparently negligible, and which, moreover, are largely arrested in the meter before they reach the consumer.

Ammonia is frequently passed into the purifiers to prevent the "souring" of the oxide. It is easy to imagine that an overdose of this remedy is occasionally given, to the detriment of the meter.

The introduction of carburetted water gas is sometimes blamed for being responsible for the meter trouble. If equally well purified, there should be no difference in corrosive action between water gas and straight coal gas,

except as regards the higher percentage of paraffin hydrocarbons in the former, which are usually associated with bad cases of deterioration. In this respect, much greater difficulties are due to the practice of using petroleum hydrocarbons or tar distillates of comparatively high boiling point for the purpose of naphthalene removal. Possessing much higher dew-points than the bulk of the aromatic hydrocarbons "naturally" present in coal gas, they are apt to be arrested and scrubbed out in the meter, dissolving and extracting the oil dressing from the diaphragm, and exposing the bare leather to the chemical action of corrosive gases or vapours. Recent proposals for spraying such high-boiling distillates as ordinary kerosene or lamp oil into the gas must, therefore, be regarded with some concern by the meter department of the respective undertakings.

It is highly desirable that further extensive work should be carried out for clearing-up the points involved in this inquiry, and to prove beyond doubt the contentions suggested by the results so far obtained, and which, under the prevailing circumstances, have not gone beyond the preliminary stages.

The work done was mainly intended to clear the ground, and to indicate the lines along which future research should proceed. In view of the large amount of capital locked-up in gas-meters, the results, as far as they go, seem to warrant that closest attention should be given by gas undertakings to their care and to the causes making for their destruction.

(Signed) R. Lessing.

OBITUARY.

JOHN DEMPSTER.

It is with regret that we have to announce the death, suddenly on the 7th inst., at Keele Hall, Newcastle-under-Lyme, of Mr. John Dempster, aged 62 years. He returned home on Tuesday, and was stricken with hemorrhage of the brain while dressing for dinner; passing away the following afternoon. A few weeks ago he was taken ill, and his doctor suggested that his state of health was such that he must at once reduce his business responsibilities. Application was made for the release of his only son, Captain Charles Dempster, R.F.A., but without success. Though it was thought desirable that he should take complete rest, his sudden decease was altogether unexpected.

Deceased was second son of the late Robert Dempster. He, together with his brother Robert Dempster, established, in 1885, the firm of R. & J. Dempster, Newton Heath, Manchester. His training as an engineer commenced under his late father; and he has always actively followed any new feature bearing upon the profession he had so much at heart. His immediate grasp of essentials bearing upon a difficult situation enabled him to give a reasoned decision. Hence his opinion was always of value to the many and various concerns he was connected with. Owing to the unquestioned ability of the two brothers, supported by a trained staff and a newly-equipped works, the business prospered from its very commencement; while its scope was enlarged until it was recognized as one of the largest of its kind. Mr. John Dempster was always a strong driving force, and in the early days was never absent from his duties. He commanded the best efforts of others by his fine example and integrity and ability.

He was married in 1881, and is survived by his widow and two children. The only surviving son, Captain Charles Dempster, married a daughter of Sir Edwin Holt; and his daughter is the wife of Major W. Dickens Heywood, who was recently invalided home from service in the Dardanelles.

Mr. John Dempster was a Director of, and took an active part in the management of, the Carnbrae Chemical Company, the Furnace Gases Company, the Glengarnock Chemical Company, the Langloan Iron and Chemical Company, and the Whitwood Chemical Company—all of which are mainly devoted to dealing with bye-products of gas. He was largely interested in many gas, chemical, and iron companies; and his advice was often sought by them, though he was not officially associated with the concerns. His greatest personal achievement was the extraction of bye-products from blast-furnace gases, at a period when such means were little understood; and with all our modern progress the principle he established is as sound to-day as in 1886, when first introduced. As a speculator, his success in most instances was extraordinary; and his opinion regarding the trend of things was always good, and worth acting upon.

Considering his sound views, it would appear strange that he always avoided public life; and though his presence was often desired, he invariably declined personal appearances. Yet his purse was ever open to assist a cause finacially; and many local and general institutions will feel his loss thereby. He had been a great traveller, and whenever opportunity permitted, he always actively sought out any new feature bearing upon the profession he loved so well; and the result of his foreign experience has borne fruit in many of the concerns he was connected with. In his later years, whenever opportunity permitted, he devoted his leisure hours to fishing, shooting, and yachting, to all of which he was ardently attached; and few men of his age could outstay him at any of these sports. He was becoming much attached to his beautiful residence, Keele Hall; and after leading such a strenuous life, it is to be regretted he was not spared longer to enjoy it.

Mr. John Dempster was always proud of the fact that he was still associated with many of the staff, who were with the firm at its birth; and we are sure to these the loss of a chief who was always courteous and considerate will bring many regrets. Some who have passed through the works, and now occupy important positions in the gas profession, will doubtless join in the sorrow of the family.

The remains were interred at St. Paul's Church, Kersal, on Saturday; and the funeral was largely attended by mourning friends, staff, and workmen—a considerable number coming from Scotland, where, until the last few years, the deceased resided at Methven Castle.

Among the crew on board the armoured cruiser "*Black Prince*," reported lost in the Jutland naval battle, was Mr. Arthur Hickson, son of Mr. Herbert Hickson, the Manager of the Gas-Works, Tickhill, South Yorkshire. He joined the Navy eight months ago.

Mr. Mark Fligg, the Secretary and Manager of the Redcar Gas Company, died early last Friday morning, after only a few hours' illness. A heart attack was the cause of death. Mr. Fligg was a native of Dewsbury, but removed to the Cleveland coast as a young man; and 37 of his 60 years were spent as Manager of the Redcar Gas Company, who supply, in addition to that town, the neighbouring localities of Marske and Saltburn. He was a member of the Institution of Gas Engineers, and was at the recent annual meeting elected President of the North of England Gas Managers' Association. He leaves a widow and two sons. One son, Mr. Clarence Fligg, is Manager at the Spennymoor Gas Company, and the other, Mr. Edgar Fligg, is on the staff of the Redcar Gas Company. The interment took place yesterday.

Mr. C. E. Bloomer, who was for many years a Director of the Halesowen Gas Company and Chairman since 1887, also a Director for some years of the Cradley Heath Gas Company, died last Saturday week, aged 69. The deceased gentleman was one of the founders of the Murdoch Lodge, and the first Senior Warden. He was also the recipient of many Provincial Grand Lodge honours. At the funeral last Wednesday, some representatives of the companies with whom Mr. Bloomer was connected were present—among others, Mr. Thomas Berridge, J.P., the Chairman of the Cradley Heath Gas Company, together with Mr. Charles Dakin, the Secretary and Manager. Mr. Dakin and Mr. R. T. Pearson also attended as representing the Halesowen Gas Company, as well as Mr. J. N. M'Coll and Mr. D. W. Sluter, the Manager and Secretary respectively.

PERSONAL.

Mr. Arthur F. Ames, of Church, Lancashire, has been appointed Engineer and Manager at the Silsden District Council Gas-Works, in succession to Mr. Balmforth, who recently left to take up another appointment. There were 34 applications for the post.

When the late Mr. William Ford retired from the position of General Manager of the Stockton-on-Tees Corporation Gas-Works, Mr. Matt Dunn (at that time Assistant Manager) was appointed to the vacant post for one year; the understanding being that at the end of the period the question of making a permanent appointment should be considered. The twelve months having expired, and the good work of Mr. Dunn being evident, the Gas Committee recommended at the last meeting of the Council that he be appointed permanently to the position of General Manager, at a salary of £650 a year, to be increased by annual increments of £25 up to £750. The Committee's recommendation was unanimous, and so was its adoption by the Council.

Mr. Thomas Carmichael, who for the past 19 months has been Superintendent of the Eastcroft Gas-Works, Nottingham, has been promoted to a similar position at the Basford Works—the largest station of the Nottingham gas undertaking. On Thursday last, an interesting function took place in the mess-rooms of the works, when Mr. Carmichael was presented, as a mark of esteem, with a silver tea service and plate, subscribed for by the whole of the staff and workmen. On making the presentation, Mr. Worthy, General Foreman, in wishing him success, spoke very highly of his work. He was ably supported by Messrs. Teague, Downs, Saltinstall, and Loam, all representing various departments of the works. Mr. Carmichael suitably replied, and expressed his deep appreciation of their handsome gifts. Thereafter a pleasant hour was spent.

Gas-Purifying Material.—The Swedish Chamber of Commerce for the United Kingdom is in receipt of a cable from the Swedish Board of Trade, Stockholm, to the effect that gas-purifying material (used) has been added to the list of goods which are now prohibited for exportation from, and for transit through, Sweden.

INSTITUTION OF GAS ENGINEERS.

Notes of Proceedings at Last Week's Council Meeting.

A Meeting of the Council was held at No. 39, Victoria Street, Westminster, on Monday afternoon, the 5th inst.—the President, Mr. John Young, presiding.

A resolution with reference to the death of Sir Corbet Woodall was adopted for submitting to the members at the annual meeting. [This appears on p. 565.]

The arrangements resulting from the special meeting of the Council held to consider the subject of organization in the gas industry were reported.

Reports of the Emergency, Finance, and Publications Committees were presented and adopted.

It was agreed that the title of the Ventilation Research Committee be altered to the Gas Lighting, Heating, and Ventilation Research Committee.

Mr. H. J. Randall, of the Yorktown and Blackwater Gas Company, and Mr. J. C. Wright, of the Romford Gas Company, were transferred from the class of associate member to that of member. Mr. Leslie H. Eady, of Southampton, was approved as a candidate for the class of associate member.

The vacancies upon the Advisory Committee on the Livesey Professorship of Coal Gas and Fuel Industries at the Leeds University, and on the Life of Gas-Meters Research Committee, caused by the death of Sir Corbet Woodall, were filled by the appointment of Mr. W. Doig Gibb on the former case and of Mr. W. R. Herring on the latter.

It was reported that Mr. W. B. Farquhar had been appointed District Member of Council to represent the Eastern Counties' Gas Managers' Association for the year 1916-17.

Institution certificates for gas-fitters were granted to twenty applicants.

Presentation to Mr. and Mrs. Dunn.

During the afternoon a break in the proceedings occurred for the purpose of a presentation to the Secretary and his wife. It consisted of a handsome silver tea and coffee service, which bore the inscription: "Presented to Mr. and Mrs. W. T. Dunn, on the occasion of their Silver Wedding, by the Council of the Institution of Gas Engineers, with best wishes, May, 1916."

The President, when making the presentation, delivered a particularly happy speech, conveying the felicitations of the Council which they by their applause cordially endorsed. Mr. Dunn in acknowledging the gift, warmly expressed appreciation of the kindness which had prompted it. He referred to the happy relations which had always subsisted between the officers, Council, and himself from the time of his appointment as Secretary twenty years ago. He assured the Council that this token of their regard would be highly treasured. Mrs. Dunn, who had been specially asked to be present on the occasion, also spoke a few words of grateful appreciation.

It was announced at last week's general meeting of the Institution that all the members and associate members on the balloting list had been duly elected. They were:

MEMBERS.

Allison, Edwin, Gosport.
Brettle, Joseph, Sedgley.
Carder, Charles Henry, Oldbury.
Chadderton, Frederic, Barrow-in-Furness.
Clarke, Arthur L., Maldon.
Curr, Thomas, Vauxhall.
Fiddes, George Bernard, Leicester.
Grainger, Barton, Rhymney and Aber Valleys Gas and Water Company.
Jackson, William Clark, Neath.
Luxon, Reginald George, Launceston.
Mainwaring, William Henry, Lincoln.
Masse, René, Société d'Eclairage, Chauffage, et Force Motrice, Paris.
Nield, Thomas H., Hebden Bridge.
Robinson, Cecil John, Spalding.
Singleton, Harold, Huddersfield.
Stone, Glanville Dennis, Wanganui, New Zealand.
Wyatt, Arthur Robert, Seaton.

ASSOCIATE MEMBERS.

Bevington, Stanley Alfred, Royal Arsenal, Woolwich.
Cross, Douglas Cleave, Lea Bridge.
Johnson, Stanley Barker, Colombo Gas and Water Company.
Pearson, George Charles, Birmingham.
Perkins, George, British Gaslight Company, Hull.
Stone, Harold Edmund, Birkenhead.
Whitehead, Sidney Edward, Southport.

The use of gas in laundries is well and fully dealt with in the June issue of "A Thousand-and-One Uses for Gas," issued by the British Commercial Gas Association.

ELECTRICITY SUPPLY MEMORANDA.

A REPLY has not been drawn by the criticism made last week of a letter by Mr. J. Horace Bowden, Electrical Engineer of Poplar, in which he suggested that the attention of the Board of Trade might be called to the electrically generated "fact" that coal could be "saved" by the mere transference of lighting from gas to electricity, without taking into consideration what relatively happens to the coal when it is carbonized in retorts, and when completely destroyed under boilers for the generation of steam. Perhaps the reason for this neglect is that we were not so open as we ought to have been in giving a proper description to this performance of Mr. Bowden, or perhaps that gentleman now appreciates that he has been rambling, and the least said the soonest mended. The German Fleet long before the British Navy wished the recent North Sea affair to end, hied itself back to Kiel as fast as steam could take it, locked itself in, and proclaimed to the world that it was busy rejoicing in its wonderful "victory," though it did not succeed in the great enterprise, whatever its nature, that it went out to achieve. Mr. Bowden came from his base on a little expedition, which was to try to convince a Government Department, by the aid of a very foolish little letter, of a method of "saving" coal. When attacked, he simply shut himself up in his East-end "Kiel;" and it may be that from there he is privately telling all and sundry who are interested that he has given the "enemy" a nasty shaking.

No Reply.

Apart from the main question as to what is done respectively by the gas and electricity industries with the coal they use, it will be remembered that Mr. Bowden in his comparison took for electricity the best possible performance of a perfectly new turbine generating plant with the low coal consumption of 3 lbs. per unit generated. It was pointed out to him that his claim, while representative of the best electrical engineering practice, was not representative of the ordinary run of electricity stations—only of those whose circumstances permitted of the installation of a new turbine plant. Since his letter appeared, a report has been published from Stoke-on-Trent which shows the wastefulness of small electricity stations, and the economy of modern turbine plants. The figures in parentheses are the costs per unit, at the price paid for the coal. At the Burslem station, 8 lbs. of coal were used per unit generated (0·59d.); at the Hanley station, 12 lbs. (0·96d.); at Longton, 21½ lbs. (1·49d.); at Stoke, 13¾ lbs. (1·04d.); at the sub-works, 11¼ lbs. (0·87d.). Now compare these widely differing figures with those for the Stoke power house—2¾ lbs. (0·23d.). The old stations, it is seen, are using four times and more coal than the new turbine plant; and if a further turbine set displaced the old plant, the saving in coal used should practically pay the capital charges on the new plant. There is room for tremendous coal economy at Stoke—and elsewhere. The "Electrician" states that the expenditures of coal per unit at the old generating stations at Stoke are not by any means isolated cases. "There are numbers of comparatively small stations in the country in which the coal consumption is necessarily very high." But articles and papers veneered with plausibility are published regarding the profitableness of small electric stations. And Mr. Bowden compares the work of a 3-lb. per unit generating plant, and lamps of a so-called illuminating efficiency of 1 candle per watt, with the poor efficiency of 16·5 candles per cubic foot for gas; and he was so busy making this immaculate comparison that he forgot that a ton of coal, as treated by gas-works, does a lot of other things than produce gas for lighting purposes. We can leave it at that, unless Mr. Bowden likes to come out, and attempt to defend himself.

Wasteful Electricity Stations.

A large amount of interest has been evoked by the advice of the Coal and Coke Supplies Committee, communicated to the electricity industry through the Board of Trade, regarding the subject of the interlinking of electricity supply stations, in order to economize in the use of coal. It will be remembered that the Board were "advised" that in "many cases," the necessary arrangements could be made at once—that is to say, that practically at the word of command, interlinking of electricity systems could be established. There are many considerations (engineering and commercial) which would have to be the subject of consultation and negotiation. It is not by any means the simple matter that it is supposed to be by the Board. However, "Electrical Industries" makes the pertinent suggestion that it would be a convenience if the Board published a list of the "many cases" of undertakings the systems of which could be interlinked at once. It would indeed be most helpful to know which of the undertakings are so notoriously eligible for this purpose that their eligibility has travelled to the ears of the Board of Trade. Meantime, the Municipal Electrical Association of Lancashire and Cheshire has appointed a Committee of Engineers to prepare a scheme for the interconnecting of the electrical systems in the two counties wherever it is possible from the engineering point of view and commercially feasible. Sub-Committees are collecting the necessary local technical data; and later the Central Committee will present to the various supply authorities a report with an estimate of cost. Whether all this will have any practical

Interlinking.

result, or merely be regarded as something of academic interest, we cannot say; but certain it is that the matter will have to be hurried forward if it is to have any impression on electrical fuel waste during the war.

Maximum Price Charges.

Readers of the "Memoranda" are well aware how, since the war started, electricity tariffs have been jumping up by 10, 15, and 20 per cent. But some of the supply undertakings cannot, with the flights in the costs of commodities and taxation, find a living profit even at the maximum price allowed by their Provisional Orders; and they have with varied fortune applied to the Board of Trade for revision. It is gathered from the "Electrician" that so far there have been six of these special applications for a variation in the maximum price; but up to the present decisions have been given in only three cases. The Ross Electric Light and Power Company were successful; and the Newquay Company have been allowed to increase their maximum from 6d. to 7d. per unit. The application of the Charing Cross Company for permission to advance their maximum by 10 per cent. has been unsuccessful. The outstanding applications refer to Walton-on-Thames, Weybridge, and Caterham. The Board, according to our contemporary, go very thoroughly into the individual circumstances of all these undertakings to ascertain how much justification there is for exceeding the maximum; for they are cautious as to interfering with legislative enactment in regard to matters of this kind unless very good cause can be shown. Investigation is made of population, area of supply, transport facilities, character of demand, &c.; and, where the application is successful, it is restricted to the period of the war.

Daylight Saving and Electricity Charges.

When the Daylight Saving Act was passed by the Legislature, one omission was made in defence of those small consumers of electricity for lighting who really save the hour by retiring to bed when, or soon after, daylight fails. They ought, in order to put things on an equitable basis, to have had protection afforded them by the Legislature by a specific suspension of the minimum charge permitted by Provisional Orders. The tenants of villas in Suburbia who carry out the principle of daylight saving to the letter, will now, in the summer months, consume less units than formerly—some will be consuming very few units. But, nevertheless, they will find in certain instances that it is not the registration of their meters that will fix the amount of their accounts, but the old privilege of the supply authorities to enforce a minimum charge per quarter—that is to say, in most cases, 13s. 4d., the equivalent of 20 units at 8d. per unit. Under these circumstances, they might just as well sit up and utilize their 13s. 4d. worth of electricity per quarter, unless patriotism urges them not to grumble over the paying for something which they have never received, seeing that they are helping to save coal for export to neutral countries at whatever price the coal-owner can command. Of course, there will be small consolation in this for those few-unit-per-quarter consumers who have to pay the minimum charge of 13s. 4d.; but patriotism is supposed to have good tensile strength.

Faith Exemplified.

The theatres and other places of entertainment in London that are electrically lighted have to be equipped with an alternative method of illumination, or else be connected-up with two distinct sources of electricity supply—all in the interests of the public, and for their protection. A large number of people use the Woolwich Tunnel; and the Highways Committee of the London County Council have so much faith in the constancy of electricity for lighting purposes that they think it desirable that the tunnel should have an auxiliary source of lighting instantly available in the event of failure of the local supply. They are wise. Whether the method chosen is the best one that could be adopted is another question. It is proposed to make some of the lamps independent of others; and to do the lighting of the lamps disconnected from the ordinary circuit from a secondary battery. Perhaps the secondary battery will not always prove faithful when most wanted.

Overhead Wire Dangers.

Some information was given in the "Memoranda" for May 23 (p. 392) anent the dangers of overhead wires for the transmission of electricity. Electrical engineers are constantly—notwithstanding the known dangers—urging the abrogation of the restrictions upon such wires; and they point to the tramway equipment running through thickly populated cities and towns. But there is a difference in the amount of money expended on the one overhead equipment and the other. Stalwart cast-iron columns and safeguards of all descriptions are utilized in the tramway system; but this is not the equipment used in out-districts when local authorities consent to overhead wires being run. The "Electrical Review" reports that a case has recently been heard in the St. Austell County Court, in which plaintiff sought to recover £12 17s., damages to his horse and harness, and personal injuries, due to the collapse of one of the Electric Supply Company's poles on Dec. 27 last. For the defence, it was stated that the accident was due to an "act of God"—an unusual storm having blown down the pole, and strewn the wires on the road, and the horse became entangled in them. Plaintiff gave evidence and said the pole was rotten, and that those who went to extricate the horse received electric shocks. His Honour Judge Gent declined to admit the plea that the accident was due to an "act of God," and decided that there was negligence on the part of the Company. There was plenty of evidence that other people had noticed the condition of the poles and that the attention of the Company had been called to them. The plaintiff did not get all he desired, but was awarded £9 17s., with costs.

LEGALITY OF GAS CONTRACTS IN FRANCE.

A Municipal Echo of the Bordeaux Judgment.

A NATURAL sequel to the judgment of the Conseil d'Etat, affirming the inequity of the contract between the Bordeaux Gas Company and the Municipality, is the announcement by the Mayor of Bordeaux of a new temporary arrangement by which the unreasonable pressure of the present circumstances upon the Gas Company is relieved.

It will be remembered that the Municipality of Bordeaux first ignored the representations of the Company; and, on legal action being taken by the latter, they were successful in obtaining judgment unfavourable to the Company in the District Court. The case, on the appeal of the Company to the Conseil d'Etat, was returned to the District Court with the direction that the parties should come to an agreement, or if this proved impossible that the District Court should determine the amount of the indemnity to be paid to the Company and that the town of Bordeaux should bear the costs of both actions.*

As the outcome of this judgment, the municipal authorities of Bordeaux are now compelled to come to the aid of the Company for the purpose of making good the considerable loss sustained by them in maintaining its public services. As we learn from the current issue of the "Journal des Usines à Gaz" (June 5), the Company have verbally stated this loss as being 550,000 frs. per month; and hence the town is asked to consent to an increase in the price of the 2,600,000 to 2,700,000 cubic metres of gas supplied per month, or else to adopt the alternative of recouping the Company by grants from the town's exchequer. In deciding on one or other of these courses, the Municipality have found themselves in a cleft stick. Their resources do not allow them to contemplate the payment from the treasury; and, on the other hand, they find themselves at a loss to justify the greatly increased charges for gas without, so they profess, a lengthy investigation of the Company's working, which it recognizes would further tend to aggravate the great difficulty of the situation.

Thus they are compelled to act quickly, and to adopt a scheme which promises the least inconvenience to the community. They have considered the proposition of passing on to the consumers part of the additional cost, and defraying the remainder from the general local taxation, as has been done in Paris. But they have judged it inequitable to apply to the whole of the community a charge which properly belongs to consumers. The community as a whole will pay its part in the new charges for public lighting. As the outcome of these considerations, the town has come to an arrangement with the Company, according to which the terms of the original contract of 1904 are suspended, and a provisional tariff established in its place. For private consumers, the price of gas will be increased by 18 c. per cubic metre, and for all other classes of consumer by 21 c. In any monthly period where these increases do not suffice to provide for the working of the Company, the balance will be made up by the town.

A suspense account will be created in the Company's books, and all sums derived from the increase in price credited to it—the operation of this suspense account dating from the decree of the Conseil d'Etat. It is further arranged that during the period of this provisional contract, the Company's books of receipts and expenses are to be open to inspection by a Committee appointed by the town.

The Company are also to receive the sum of 600,000 frs. for disbursement until the increase in the price of gas shall have produced a useful effect. This sum is being advanced by a bank. Should it prove insufficient for the Company's requirements, the town will take other measures to repair the deficiency.

As regards the maintainance in the future of this provisional contract, it is provided that in the absence of mutual arrangement or legal interference before Dec. 31 next, the present contract can be cancelled by either party on a month's notice, on the understanding that on such cancellation both parties shall be in the position in which they were respectively placed immediately before the provisional agreement came into force. Moreover, the new agreement is entered into expressly without prejudice to the conditions of the application of the judgment by the Conseil d'Etat in respect to the rights of either party. It is merely accepted as in no way modifying the situation that naturally follows from the judgment.

It is interesting to note that the proposed agreement on being put to the vote in the Bordeaux Municipal Council was adopted unanimously, and without discussion.

* See "JOURNAL" for April 11, p. 75, and April 18, p. 127.

BRITISH HEAT-RESISTING GLASS.

Of so great importance to the gas industry is the production in this country of heat-resisting glass, possessing, if possible, qualities equal to that which used to be imported before the war, that those who endeavour to supply the need are fully entitled to expect for their efforts every encouragement from users. The problem, it is known, is not a simple one; and at present there are unusual difficulties in the way of starting in any new line of manufacture. This makes the more laudable the endeavours of those who do put forth efforts to meet the situation; and it is to be hoped that, when easier times return, the help they have rendered will be borne in mind. The support accorded them must not be only "for the duration of the war."

Reference has already been made in the columns of the "Journal" to steps taken for the production in England of glass which fulfils all the conditions imposed by present-day gas lighting; and to what has been said, it is now possible to add the information that the Charnley Manufacturing Company, Limited, of Whitefield, Lancashire, are in business with the intention of dealing exclusively in one particular make of British glass. On the production of this glass, much time and money have been spent; but those connected with the Charnley Company who have been devoting their attention to the matter are firmly convinced that now they have practically got the glass to perfection. It is, in fact, so far as their tests can prove it, equal in its heat-resisting qualities to glass of best German and Austrian manufacture. With such a claim as this advanced in its favour, there can be no doubt whatever that the distribution departments of gas undertakings will be eager to make full and fair trial of this new glass; and should the trial prove, as is confidently expected by the makers, that the glass not only looks, but is, like the best Jena, then the gas industry will be able, at one and the same time, to help itself and a British manufacturing process. We shall most of us after the war is over probably have a keener understanding than has hitherto been widely prevalent of how often it is that patriotism pays.

Being assured that they have reached so satisfactory a stage from the point of view of quality, the Charnley Company are now turning their attention to producing the glass as cheaply as possible; and it is felt that, when the price of materials and labour returns to nearer normal, they will be able to approximate pre-war prices—if the industry will give them that encouragement at the present time which, as already remarked, is well deserved. It is pointed out that the initial expenses are great, and the training of workmen is costly; so that only the co-operation of the industry will make it possible for the manufacturers to place the business on such a footing that it will be able to hold its own when competitive times are with us again. Should the glass prove in use to be all that is said, we feel sure this co-operation will not be looked for in vain.

One other important point may be mentioned in reference to what the Charnley Company are doing. Globes are now being made for burners and lamps of practically all sizes; and what is being tried is a standard sized globe to fit those lamps which are approximately the same size—any small variation being made up by supplying adapting rings. The popularity of such an arrangement as this from the storekeepers' point of view need hardly be questioned.

THE FRENCH PROFESSIONAL SYNDICATE OF THE GAS INDUSTRY.

The annual report of the Syndicate for the year 1915, to which general reference was made in last week's issue, covers, as will be readily understood, a period presenting many special difficulties connected not only with the preservation of such important public services as lighting and heating, but with the inauguration of new branches of manufacture as part of the national defensive effort of France.

The President, M. René Masse, sought to pass in necessarily rapid review the work of the Syndicate, first in dealing with the aggravated forms of problems which in normal times come before the Syndicate for their solution, and, secondly, in originating, organizing, and supervising activities urgently demanded as part of the national defence. M. Masse echoed the universal military order to close ranks and redouble efforts as the watchword in every sphere of life—the certain mark of effective resistance and final victory. In this spirit they have laboured to enhance the cohesion and power of the Syndicate, already with conspicuous success, and have shown their resolve to prosecute unremittingly this essential part of their programme. The result is evidenced by the 56 additions to the membership, among them, M. Ellissen, representing the Compagnie Générale du Gaz pour la France et l'Étranger. Moreover, the solidarity of the industry has been advanced by the more frequent and general communications——some in reference to appeals for assistance, and many others in anticipation of circumstances causing embarrassment to the whole industry and, in turn, arousing still other requests. In a word, the Syndicate has exerted a healthy and active centralizing influence by which the industry has been more firmly welded and its operations unified; and it looks hopefully forward to see itself completely representative of the French gas industry as a fitting welcome to gas men in Alsace and Lorraine on their re-union with the French nation.

But the Syndicate has been concerned not only with increasing the numbers of its adherents; it has, at the same time, sought to intensify its working capacity, its channels of inquiry, and, consequently, its influence in the various spheres in which the interests of the industry lie. It thus proceeded to render more intimate its association with civil or military authorities, has not ceased to place itself in communication with leading ministers of State and heads of public bodies by whom, it is pleased to record, its representatives have been cordially received. Real collaboration between the various Government departments and the Syndicate have been established in this way, and is naturally highly esteemed by it.

The number of communications to its members has undergone a great increase since the outbreak of war. In August, 1915, the Syndicate commenced the issue of monthly circulars dealing with legislative and regulative documents of application to the gas industry; and it has also circulated a special memorandum doing the same thing for the preceding twelve months. Its sessions for the discussion of matters relating to the industry have been held fortnightly since March last; one meeting in the month being assigned to matters of litigation and to the question of increase in the price of gas, and the second to all other current subjects. In the Syndicate's work connected with litigation, great appreciation is recorded of the help of M. Ed. Kaeuffer and of the Syndicate's Solicitor, M. de la Taste. In this way, and by the service of special committees, an immense amount of administrative work had been got through. One indication of the Syndicate's activity is the fact that the letters and questions received and answered in the course of a month number several thousands.

For its more adequate accommodation the Syndicate has arranged to occupy premises at No. 12, Rue de Clichy, where also it is proposed to transfer the headquarters of the Société Technique and the "Journal des Usines à Gaz." It is hoped the Central Committee for "Cokes Françaises" may also find quarters in the same thoroughfare, and that, in fact, the head offices of other gas bodies may be centralized in the near neighbourhood.

Regarding the question of coal supplies, the salient facts of which have already been recorded and have been embodied in a circular, "The Gas Industry and the Coal Crisis," published by the Syndicate, the means of relief for the French gas industry have been defined as follows: (1) Securing coal from the English mines at a fitting time and to the requisite tonnage; (2) arrangement of a price, not unduly inflated; (3) freightage to French ports at not unreasonable rates; (4) prompt discharge of cargoes for the avoidance of demurrage fees—in other words, adequate discharging plant and labour; (5) provision of trucks for the immediate distribution and for saving the cost and labour entailed by delay at this stage. It is recognized that, however closely private enterprise is applied to factors Nos. 4 and 5, the success or otherwise of these measures rests always in the hands of the French Government. Hitherto, there have been many expressions of goodwill and certain efforts without any positive result. It is hoped that, in the pressing national circumstances, the interests of the allied cause will not require to suffer from the application of strictly commercial methods. It is specially urged that priority should be granted at French ports to cargoes of gas coal, that, in default of prompt provision of waggons, temporary ground by the docks should be reserved for the discharge of coal. All barges should be requisitioned for the use of importers of gas coal, either for serving floating bunkers in ports, and so expediting discharge of cargoes, or for transport to works. Similarly ground should be reserved adjacent to railway lines to receive coal, or even for making-up into stock while waiting the supply of trucks. These measures, it is suggested, should be supplemented by the help of the State Railways in a way similar to that offered to the gas industry at the outbreak of war.

The Syndicate acknowledges the friendly recognition of French gas-makers' difficulties which has been expressed in England—particular by the Cardiff Chamber of Commerce, which, in January last year, called for measures by the British Government in relief of the situation in France in the shape of reduced freight rates, a limit to the price of coal, and increased tonnage by reducing the periods during which ships requisitioned by the Government remain idle, and by prohibiting the carrying of useless cargoes. It was then suggested that freight rates might be limited to double those in 1912, and that the Government frees the shippers from war risks; also that cargoes of coal should be prohibited in all British ports to neutral vessels not complying with British regulations, and that steps to secure greater tonnage should include prohibition of larger cargoes to neutrals than before the war, and exclusion from the United Kingdom of imports other than foodstuff and materials for the manufacture of munitions and our own industries. The Syndicate looks back with regret on the non-materialization of the benefit which could have resulted from the adoption of these measures. It was still concerned (at the time of the report) with the gravity of the situation, and sceptical of relief from projected legislation. It realized that the remedy must be more direct, and strike at the root of the evil—viz., the price of the coal. The application to French gas-works of the price fixed to those in England by the Runciman Act would mean a benefit of at least 4s.; and the Syndicate announces its intention of vigorously pressing on the Allies such a concession

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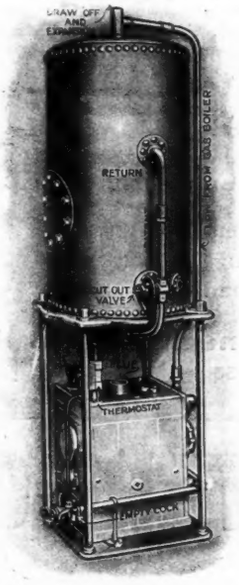

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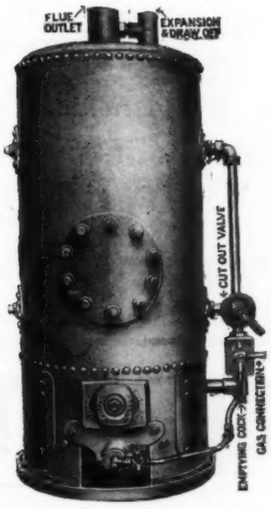

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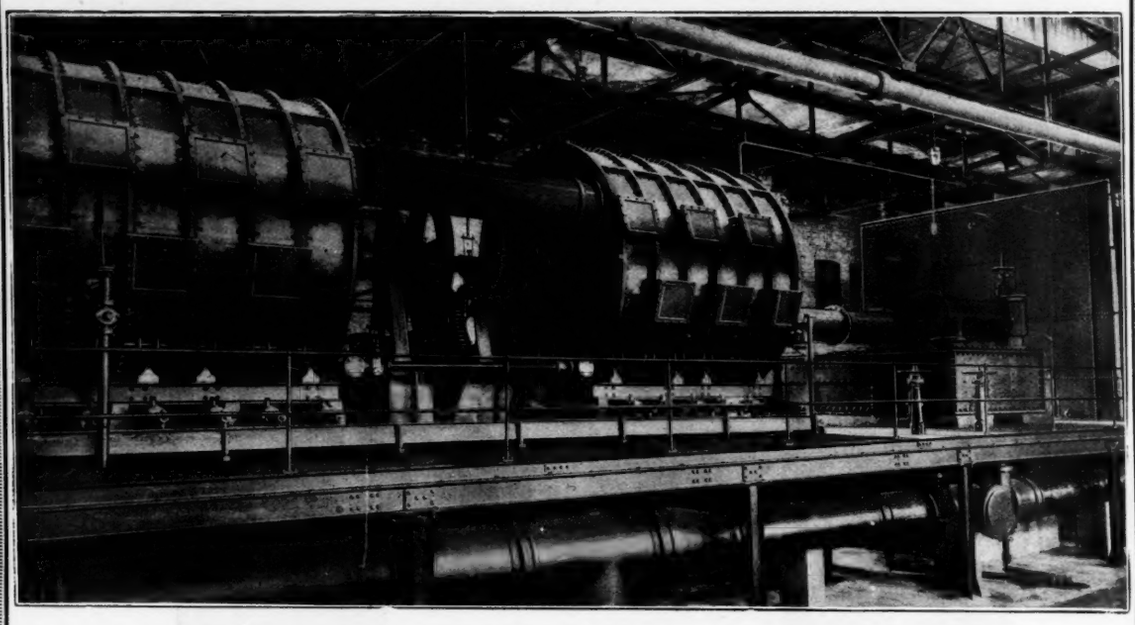

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in this matter as in that also of freight, at the same time without relaxation of its efforts to obtain from the French Government the measures which are part of the scheme of relief. In this it is hopeful of success.

The Syndicate has likewise given its consideration to the position of gas undertakings under those articles of the Finance Act of 1914 which set forth the principle of right to reparation "of material damage sustained as a result of the war." It was felt that the Special Bill of May, 1915, did not determine the fate of bodies holding concessions for public services, and this threatened to leave them outside the benefits contemplated in the common legislation. It therefore laid its views before the Commission of the Chamber of Deputies entrusted with the matter, with the result that concessionnaires have been defined as coming in the same category as other dependent bodies in respect to the adjustment of damages included in the Government's legislation. It is thus believed that this timely action will result in prompt settlement of litigation after the war, in regard to works which for the time have fallen into the hands of the enemy.

GAS SUPPLY IN A BOMBARDED TOWN.

THE annual report of the gas and water undertakings of the little town of Sainte Marie aux Mines or Markirch (on the German side of the frontier in Alsace), for the twelve months ended March 31 last year, which has just been issued, gives some interesting particulars as to difficulties of gas and water supply in a town which is within range of hostile artillery.

The first difficulties arose when mobilization took away many of the gas workers, whose places had to be filled by untrained hands. Shortly afterwards the Manager of the gas and water works, Herr J. Gümbel, was taken by the French troops as a hostage. The lower town was bombarded by the French on Oct. 31 and Nov. 1, 1914, and the gas-works were damaged so badly that work had to be suspended. The damage comprised holes in the bells of both the holders, the destruction of a purifier, much injury of buildings—especially their roofs and windows—and slight damage to the mains, &c., above the retort-settings. The more important plant, however, suffered comparatively little; and, after an interruption of seven days, it became possible to resume working to a limited extent, with only one holder and two purifiers. The repairs which were absolutely necessary for maintaining a regular supply of gas were carried out in the ensuing winter; but other repairs were held over in view of the risk of further bombardment.

The position of the town relatively to the field of war rendered it very difficult to secure a sufficiency of coal; and as the firm which had hitherto supplied the gas-works failed it entirely, it became necessary to secure supplies of Westphalian coal, which gave a much lower make of gas per ton than the coal formerly carbonized, and was considerably dearer. The profit on the year's working consequently fell from 53,434 marks in 1913-14 to 21,352 marks [about £1047]. The total production of the works—viz., 1,074,840 cubic metres [37,958,620 cubic feet] was only slightly less than in 1913-14; the decreases in consumption by private consumers and for public lighting being offset by the increases in the consumption in municipal buildings and in the accounted-for gas.

The trunk water-main to the town was broken by a shell on Oct. 16, 1914, but its repair was finished the following day. It was found possible to maintain a supply of water without interruption from the water-tower and pumping-station.

Coal Tar and Ammonia.—The fifth and enlarged [English] edition of Lunge's "Coal Tar and Ammonia" has just been received from the publishers, Messrs. Gurney and Jackson. The book is in three parts; the first and second dealing with "Coal Tar," and the third with "Ammonia." A fuller notice of the work will be given in a subsequent issue of the "JOURNAL." The published price is £3 3s. net.

Institution of Municipal Engineers.—The members of this Institution will pay a visit to Windsor on Saturday, July 1. On arrival they will proceed by launch to the water-works, where they will be received by the Mayor (Mr. W. Carter, J.P.). After an inspection of the works the members will re-embark and proceed up river to Maidenhead, returning to Windsor in the evening. They will be entertained to tea on board by Mr. E. A. Stickland, the Borough Surveyor.

Enemy Businesses to be Wound-Up.—Among recent orders which have been made and notified by the Board of Trade requiring certain businesses to be wound-up are the following: Krupka and Jacoby, Limited, 26-36, Chapter Street, Westminster, London, S.W., importers of electric and gas fittings, &c. [Controller: Thomas Wise, Bassishaw House, Basinghall Street, London, E.C.] Badische Company, Limited, 2, Samuel Ogden Street, Whitworth Street, Manchester, aniline dyes. Bayer Company, Limited, 20, Booth Street, Manchester, aniline dyes. Berlin Aniline Company, Limited, 30, Princess Street, Manchester, aniline dyes. Kalle and Co., Limited, 25, John Dalton Street, Manchester, aniline dyes. Coke-Oven Machine Company, Limited, care of Messrs. Gillespie Bros. and Co., 29a, Charing Cross Road, London, W.C., manufacturers of coke-oven machinery.

THE SCIENTIFIC UTILIZATION OF COAL.

Waste of Bye-Products.

At the meeting of the Institution of Mining Engineers last Thursday, Sir WILLIAM GARFORTH, the President, referred to the work of the Advisory Council for Research, who had established strong standing Committees concerned with the most important industries, whose main function is to advise the Advisory Council. In calling attention to the fact that the Institution of Mining Engineers had been asked to nominate members for one of these Committees, Sir William mentioned some of the lines on which investigations might proceed as regards the coal-mining industry. From the somewhat lengthy address, we extract the points of more immediate interest to our readers.

One important part of the investigation, he said, was to inquire into the national loss which was being entailed by neglecting to recover more of the valuable substances of which coal was composed. It was hardly necessary to remind the members of the Institution that coal was the raw material from which, in the production of coke, ammonia, tar, and benzol were obtained. The ammonia, when converted into sulphate, was most valuable to agriculture as a fertilizer. In other forms it was needed by the woollen and calico industries, for the manufacture of permitted explosives, as the refrigerating medium by which cold storage was made possible, and it was also largely used in the chemical, electrical, and other trades. Tar, with its hundreds of derivatives, was essential in the dyeing industry, and for the production of high explosives; to the medical and surgical professions, for drugs and antiseptics; to the rubber and photographic industries, for solvents and developers; besides being required in the raw state for road making, felt-making, &c. Benzol, besides supplying an additional raw material for the above purposes, was also used as a fuel in internal-combustion engines, and furnished refined products required for many somewhat similar purposes to the tar derivatives.

Though the distillates of coal were essential to many industries, only about 20 per cent. of the output of this country was at present carbonized; and the whole of the tar, ammonia, and benzol contained in the remaining 80 per cent. was therefore lost. The reason for this was presumably that the colliery companies had been able to find a more profitable market for their coal without erecting coke-ovens, or old colliery concerns may have exhausted their good seams and the remaining seams were too inferior to warrant a large expenditure in recovery plant. But the time had now arrived when coal should no longer be regarded simply as a fuel; and every member of the Institution ought to be conscious that the nation was getting the greatest possible value out of the coal he was producing. It might be mentioned that of the quantity carbonized, 5,000,000 tons a year were being burnt in beehive ovens, without obtaining the recovery of any bye-products. This alone represented a loss to the nation of 70,000 tons of ammonium sulphate, 250,000 tons of tar, and 12,000,000 to 15,000,000 gallons of benzol, all of which could be saved if the coal was distilled in retort ovens.

In connection with the distillation of coal, inquiry should be made into the possibility of utilizing the waste gases from bye-products ovens, as there were at the present time 7000 million cubic feet of waste gas available annually, of which only a small proportion was being utilized. It might be mentioned that power schemes had been worked out with much success in some districts of this country, where the waste gases from coke-ovens and furnaces were collected and utilized. There was still ample scope for neighbouring collieries, steel-works, and public lighting and power companies to co-operate and save the continued waste of this cheap source of power. Among other sources of waste, it might be pointed out that large areas of coal had often been left in consequence of spontaneous combustion, and the fear of loss of life. Pillars of coal have likewise been left between estates, which waste it was hoped would in future be avoided. Large pillars of coal had also been left for the support of reservoirs, railways, and other structures on the surface, where the injury and cost of repairs had been insignificant compared with the value of the coal left for support. It was to be hoped that some Government interference would take place to prevent similar pillars being left in working the deep mines in the future.

It was impossible in the time at his disposal to enumerate other details which related to the proposed investigation required by the Advisory Council. He would, however, express the hope that, by a more intimate interchange of ideas between the Advisory Council, members of the Royal and other scientific societies, the Institution of Mining Engineers, and the representatives of the various industries not only in this country but in our Colonies, advantages would be gained which hitherto, for want of such combinations, had not been possible. He felt sure that every member of the Institution would be most anxious to respond to the appeal of the Advisory Council and give of his best for the sake of the country. What was required at present was a serious attempt to utilize to the fullest extent the best of every method and appliance in this country, and to abandon as soon as possible all that may be defective and detrimental. The commercial success of a country depended on a cheap supply of fuel, which might be said to be the foundation on which all other industries rest.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Centenary Meeting in Edinburgh.

The Centenary Meeting of the Waverley Association of Gas Managers was held in the Cockburn Hotel, Edinburgh, on Friday—Mr. JOHN C. M'MILLAN, of Lasswade, presiding.

The PRESIDENT, before proceeding with the ordinary business of the meeting, made a reference to the death of Lord Kitchener, who, he said, was a great soldier, and had rendered high service to his country.

THE ACCOUNTS.

Mr. DAVID VASS (Perth), in moving the adoption of the statement of income and expenditure, which showed a balance in the hands of the Treasurer of £15 12s. 1d., said that, though the money in hand was smaller than it was last year, that was owing to a donation of £5 given to the Gretna Disaster Fund. After all, there was no use hoarding up money at a time like this.

The statement of accounts was adopted.

ELECTION OF OFFICE-BEARERS.

On the motion of the PRESIDENT, Mr. J. D. Keillor, of Hawick, was elected President for the ensuing year. Mr. R. W. Cowie, of Dalkeith, was re-elected Hon. Secretary; and to vacant places on the Committee, Messrs. J. Gemmell, of Melrose, R. Hamilton, of Prestonpans, and T. Black, of Coldstream, were appointed. Mr. John O'Halloran was re-appointed Auditor.

A VOTE OF THANKS.

The PRESIDENT moved that a hearty vote of thanks should be accorded to Mr. Cowie, who, he said, had done a vast amount of work for the Association. It was agreed, as a mark of appreciation of his services, to vote Mr. Cowie an honorarium of £5.

Mr. COWIE suitably replied.

ADDRESS BY THE PRESIDENT.

The PRESIDENT then delivered the following address.

In connection with the gas industry there are (including senior and junior) about twenty Associations, all holding meetings at least once a year, and at which addresses and papers are read. It is, therefore, rather difficult for a beginner to get a new subject to speak on; but I trust that what I have to say to-day will create a good discussion.

We members of the Waverley Association are proud of the fact that ours was the first Association of Gas Managers—it being formed in the year 1861. Unfortunately, complete records of the early meetings and proceedings have not been kept; but this is not to be wondered at, as the early meetings, and indeed until quite recent years the bi-annual meetings (for such they were) were more informal and social in their character than the annual meetings of recent years. Perhaps some of our older members may have something to say upon this point and give us some reminiscences of their early connection with the Association.

Although it is now some time since the angel of death spread her covering wings over two of our stalwart members, in the persons of Mr. Joseph Hepworth and Lieutenant-Colonel Henry O'Connor, I would be failing in my duty if this occasion should pass without some little reference to the loss the Association have sustained. Mr. Hepworth was better known by the older members; but his genial and charming personality is missed by us all. Lieutenant-Colonel O'Connor was most regular in his attendance at our annual meetings—indeed, he was never absent; and last year, although he was so strenuously engaged with his military duties, he still found time to spend an hour with us, and he took part in the discussion that day.

COAL AND LABOUR.

We meet to-day still in the dark shadow of the war clouds; but we trust that long before our next annual meeting brighter prospects will be with us, and peace restored to this unhappy world. The past winter is one long to be remembered by many of us, and it is with some misgivings we look forward to the winter to come. Lasswade being in the centre of the Lothian coalfields, we had no difficulty in obtaining good supplies of coal; but the high wages paid to the miners and other workers at the pits made it very difficult for us to get labour at the works, unless we paid unprecedentedly high wages. And even though we did pay the requisite wages, the other conditions of labour—viz., the longer hours and Sunday labour—soured the men, or would-be gas stokers, that were obtainable. In my opinion, the Government has been very unfair in taking so many of the best of the gas-works' stokers—more especially when they are looking for such valuable aid from the gas industry in the form of an increased production of toluol. It is common knowledge that in Germany many of the prisoners of war are compelled to do gas-works stoking and other labour in gas-works; and I cannot understand why, in a similar way, we could not get the benefit in our gas-works of so many able-bodied German prisoners.

Although I personally had nothing to complain of regarding coal deliveries during the past winter, I am informed that all works were not so fortunate. In the midst of such an upheaval of regular conditions, it would be a miracle if the gas industry could move along and get its normal supplies without any hitch. I look with some confidence to the Coal and Coke Committee ensuring us supplies to keep us going.

The Commercial Section of the Association continues to do good work; and it is pleasing to note that the monthly returns are sent in by 80 per cent. of the gas-works in the district. These returns are a decided advantage; and I trust that in the coming year we will have the same, if not greater, co-operation than in the past. I have noticed that while every other gas-works in the district was selling gas coke at prices varying from 12s. to 18s., we in Lasswade continued to sell it at 11s. 8d. But that was not the fault of the Commercial Section.

LASSWADE AND ITS GAS SUPPLY CONDITIONS.

On coming to Lasswade, seven years ago, I naturally expected to find the conditions of gas supply to be of a more modern nature than to be found in the Western Highlands. No doubt there was a time when gas companies made and sold the gas, but took no care or interest in the condition of supply; and I am sorry to say that, even after seven years' pegging away, I have been unable to convince my Company as to the backwardness of their policy. I was very much surprised to find, and I am sure you will be surprised to hear, that our Company supply only slot meters, and even these only when circumstances compel them to do so. All ordinary meters, both wet and dry, belong to the proprietors of property. When a person wants a supply of gas, he makes application either at the Secretary's office or at the gas-works. He is then told that the gas-main passes his house at such and such a place, and that he can get his connection from it. He is also told that he must buy his own meter and do all the work from tapping the Company's mains to fixing his own burners.

This policy, as you can all easily see, is very fruitful of worries for the manager. For instance, when he is on the survey he occasionally comes across a meter which has ceased to register; and all he can do is to intimate to the consumer that his meter is standing and he cannot get gas till it is put right. The consumer then writes to the factor, who sometimes requires to write to the landlord, who takes a few days to consider it; and then if he decides to do anything he instructs the factor, who then engages the local plumber to have it seen to. The plumber then removes the meter, sends it to the makers for repairs; and by the time it is returned two or three weeks may have elapsed, and the consumer has been all the time without a supply of gas. In some cases there is a bye-pass fixed during the time the meter is away, and an estimate is made of the gas used during the period.

This is only one incident of many that are continually cropping-up with regard to the meters. Here is another very frequent one. A consumer who has always been accustomed to get gas supplied through an ordinary meter removes to a house where there is a slot-meter. The consumer comes and asks that the slot-meter be removed and an ordinary meter substituted. As the Company do not supply ordinary meters, unless the landlord provides an ordinary meter the consumer has either to content himself with a slot-meter or do without gas. I have a great deal of sympathy with the landlord in many cases, and I do not wonder he often loses his temper. He may have just provided some of his property with new ordinary meters when he gets tenants who may only want slot-meters and who could not very well be trusted with a credit or ordinary meter. Should the Company decide to put in slot-meters there, these new ordinary meters are put out of action and lie in a cupboard till a new tenant comes along who wants an ordinary meter.

As already mentioned, the proprietor has to be at the expense of the service-pipe from main to meter. It is, therefore, small wonder if he puts in the cheapest service he can, with serious results to the Company at a later date. Three years ago the Company had a gas exhibition run by a firm of stove and fire makers. Since then we have hired-out gas-cookers and fixed them free; and there is no doubt that the consumption of gas has gone up considerably as a result. Since then, however, the complaints of lack of pressure have also considerably increased. On receiving such complaints I can only sympathize with the consumers, and advise them to try and get the landlord to lay a new and larger service pipe.

Again, on being notified of an escape of gas in a certain locality I sometimes find, after considerable trouble, that the escape is proceeding from a faulty service-pipe which should be lifted and relaid. Not having any power to interfere with another person's property, I at once inform the factor, who, when he feels inclined, sends for the local plumber, who in turn sends a man to repair the escape, instead of renewing the pipe. The result is, as you all well know, that the Company suffer considerable leakage, and the landlord considerable expense; and all because a cheap black iron pipe was laid in soil containing a large proportion of ashes. It has always been my contention that the gas authorities, whether company or corporation, should lay all pipes containing unregistered gas. They should also provide and maintain the meters required

for registering the gas, and supply and maintain service-pipes sufficient to give an adequate supply and pressure.

To some of those present I have no doubt the foregoing may seem strange and surely overdrawn; but I can assure them it is not the case. Neither are the customs named approved by me; but I have simply to carry out the policy of my Company.

In Lasswade and Bonnyrigg there are many houses of good property and in good localities still unsupplied with gas. In one tenement alone there are 64 different houses, only 12 of which are using gas, though all are gas fitted. The remaining 52 are waiting for slot-meters; but these are denied them. No doubt the time will come when these, too, will get slot meters. But echo answers, When?

PUBLIC STREET LIGHTING.

Three years ago the burgh of Bonnyrigg decided to instal the "A & M" pressure-wave system of lighting and extinguishing the street-lamps. The system has proved a great success; and I can thoroughly recommend it to any gas manager contemplating the automatic lighting and extinguishing of street-lamps. We were fortunate in having a small gasholder which gave 6 inches pressure. About ten minutes before lighting-up time, this heavy, small holder is put on to the town—the gas as usual passing through the works governor. The normal night pressure is 25-10ths; and in order to light the lamps, the governor is weighted to allow a pressure wave of 45-10ths to pass through the mains for about two minutes, after which it is gradually reduced to normal again. The same procedure is adopted to extinguish the majority of the lamps at 10 p.m., and again at daylight to extinguish the all-night lamps which have remained lighted when the 10 o'clock lamps go out.

CONDITIONS AT THE GAS-WORKS.

After a considerable time trying to effect a change in the purifying material from lime to oxide, I was successful, three years ago; and since then I have had very considerable relief with my purifiers. I was not able, however, to get pressure gauges and thermometers fixed; and I can assure you I miss them badly. During the winter I had on more than one occasion considerable anxiety regarding my purifiers heating. At the time we were using chiefly cannel coal; and I had fixed in the retort-house a bracket with a flat-flame burner connected direct from the outlet of the purifiers, so that any injurious effect on the gas caused by an excess of air would be at once detected. One morning, though the flame showed the gas to be all right, I was very much surprised to find the covers of the purifiers quite hot; and I felt I had just noticed this in time to turn off the air and so save serious trouble. It was about four days after before they came back to normal temperature. If I had had thermometers on the purifiers, I would have detected this much earlier.

Although I am not in the happy position to practise what I preach, I am a great believer in having pressure gauges fixed at the different points in the works and plant, so that any stoppage from whatever cause may be detected and remedied at once. Our condenser is of the atmospheric type, and comprises seven double 8-inch pipes, 14 feet long, laid on an incline, instead of being vertical as is the common practice. Whether it is because they are on the incline, or because they are too large. or because they are some distance away from the retort-house, I do not know, but they are a source of continual trouble, and an anxiety every winter, as they get choked solid with crystals. Not having pressure gauges I never know when this may happen; then it is "all hands on deck" till the choke is found and cleaned out.

Two years ago we had fixed a vertical steam-boiler, 10 feet high by 4 ft. 6 in. in diameter, with a working steam pressure of 25 lbs., and a Bryan-Donkin exhauster, coupled direct to a steam-engine, capable of dealing with 10,000 cubic feet per hour. Unfortunately, the exhauster and engine had to be placed at a distance from the works proper, and being some distance from the steam-boiler, and on the other side of a public road, the steam tends to be too soft, and irregular working results. Had it not been for the war I have no doubt the Company would have been considering plans to reconstruct the whole works, when many, if not all, of the deficiencies and the defects mentioned would have been remedied.

This review of my own local circumstances, which I believe are not unusual in other localities in the Waverley area, will, I trust, lead to a fairer comparison of working results than often is now the case. Many a manager is harshly criticized, both by his fellows or when applying for a new berth, because his unaccounted-for gas shows an excessive percentage. As pointed out by Mr. A. Canning Williams in his "Notes and Comments" in the "Gas World" of April 29 last, the terrain, the traffic, and the mileage of mains should be taken into account, as also, as I have shown, the method of dealing with services, &c. It is surely mistaken policy to allow any other than officials of the gas suppliers to have access to the mains and services.

GAS INDUSTRY AND THE WAR.

Ingratitude often shows itself where least to be expected; and it surely comes with bad grace from a Government department—forgetful, or perhaps totally ignorant, of the help rendered by the gas profession in the manufacture of explosives for war purposes—to suggest an arbitrary reduction in the output of gas, and even go so far as to give the percentage they desire, entirely overlooking another fact, that more and more as munition works become completed will gas be required for the furnaces and tools used in turning out war material. The gas profession has risen nobly to the occasion of its country's peril in its unremitting efforts to take on a new work—the extraction of toluol—as also in the great amount of judicious distribution (where the output of the existing plant was strictly limited), so that while meeting all reasonable domestic and public requirements, the nation's needs in its workshops have been met as required.

Another benefit, too, the gas industry has, owing to the war, been able to further—viz., smokeless fuel. In addition to heating and cooking by gas, can now be added the more general use by the public of coke for domestic purposes, so still further conducing to the purity of the atmosphere. Enforced daylight saving may by some be considered as prejudicial to our interests; but no doubt it will only serve as an incentive to us to redouble our efforts to increase our day-load for cooking, heating, power, and industrial purposes. When the war is over and we are able to look back with proper perspective on the development of the gas industry in munition service, and in countless other ways, we will be surprised at the great progress made.

If we were somewhat lax in our scientific research before the war, we will no doubt, in the light of what has happened, redouble our efforts; and let us hope that in after years this war may have been the beginning of greater strides in our own industry as well as in many others in our land.

DISCUSSION.

Mr. A. Masterton (Edinburgh) opened the discussion which followed the address. If the matter was not so serious, he said, he would have been inclined to say that the discourse was highly amusing, and that many of the incidents which Mr. M'Millan had recorded might almost be termed Gilbertian. They sympathized with the President in the unfortunate conditions which prevailed in his district; and their earnest hopes were that the Directors of his Company might soon be converted to more up-to-date methods for increasing their business. He could scarcely have imagined that matters were so far behind in Lasswade and Bonnyrigg—places within easy reach of Edinburgh. From what Mr. M'Millan had said, an investment in the Lothian and Bonnyrigg Company—that was, assuming that the Directors adopted a modern and energetic policy—would be a profitable one. He quite agreed with Mr. M'Millan that all the distributing arrangements from the main up to, and including, the meter, should be in the hands of the Company, and that the property should be theirs. He was certain that, if the services were laid by the Company with the best material and workmanship, the leakage would be considerably reduced, and the saving effected would cover the extra expenditure, taking into account the better feeling that would exist among the gas-consuming public. The practice of making proprietors supply meters, which often went out of order, causing delay and loss, and that of supplying only one type of meter, was suicidal. He was almost tempted to ask the President the number of consumers and the consumption of gas per mile of main, the amount of his leakage, and the proportion which his consumers represented of the total population of the district. He could hardly conceive how even a small works could carry on without thermometers and ganges attached to the various sections of the plant. These were not costly; and if Mr. M'Millan had them fixed, the troubles from his purifiers and other parts of the work would be averted. With regard to the Daylight Saving Act, from the short experience they had had of the scheme, it was quite evident that gas undertakings would to some extent suffer loss; and from the casual survey he had made, he would not be surprised if it would amount to from 3 to 4 per cent. of their annual outlays. It, therefore, behoved them all to try and replace this loss by doing everything possible to encourage the use of gas during the day. In this direction, they were obtaining invaluable help from the British Commercial Gas Association, who were adopting every means to popularize the use of gas throughout the country.

Mr. James Mitchell (Montrose) pointed out, with regard to charging consumers for meters, that his Company recently extended their mains. They gave service, meters, and bracket all complete for 6s. 6d. a point. All mains should be gone over every two years. He had brought down the leakage by 3 per cent. in one year.

Mr. John Richmond (Penicuik) expressed great surprise that in Lasswade things were actually as black as Mr. M'Millan had painted them. Pressure-gauges were so simply and easily made that he would think it hardly worth while to go to his Directors for a supply. Home-made gauges were often equal to, if not better than, those obtained from the manufacturers. Referring to Mr. M'Millan's remarks about the fixing-up of a steam-boiler with 25 lbs. pressure, he said that if they carried the steam across the road for a considerable distance a great amount of it was condensed away. What was far more economical in small works was a gas-engine.

Mr. Vass said that he had been asked by some of his friends in the Association to explain how, since the Association had been formed in 1861, this was the centenary meeting. It was explained by the fact that formerly the Association used to meet half-yearly. Giving reminiscences of the Association twenty years ago, he said that, in those days, there was no printed address by the President. They met first as a Commercial Section. All the traders were excluded from the room until they had discussed what they were going to get for their tar for the coming year. After this, the traders would be admitted. Referring to the address, he said he thought Mr. M'Millan's difficulties in connection with his condensers would be removed when he got to the vertical condensers.

They were due to the pipes being laid almost horizontal, and near the ground.

Mr. J. W. Napier (Alloa) said that when they considered that gas managers as officials were men who had been trained in the profession, it was rather discouraging to them to find that all their efforts were nullified by the policy of their directors. He was not sure but that the President had sounded a note in the affairs of the gas industry that would permeate much further than any of them thought. Having regard to the importance of the gas industry and its many-sided activities, they would require to take along with them in the direction of affairs the interests of their chairmen and their directors. Mr. M'Millan, in some measure, furnished the evidence required to prove that if it were possible to have their chairmen and directors more closely and intimately connected with the affairs of the works, such a policy as was in force in Lasswade would not be possible. It had certainly been the policy in the past that officials of gas undertakings as such had managed the whole undertaking in its commercial and technical aspect. Time was when the manufacture of gas was carried on pretty much within the walls of the gas-works. To-day the interests of the gas industry were widespread, and for this reason it was his belief that something more should be done to have a closer alliance between the directors and the members of the committees of their companies and corporations who should attend more the scientific and practical meetings.

Bye-Products of the Gas Industry.

Professor Thomas Gray, D.Sc., Ph.D., of the Royal Technical College, Glasgow, afterwards delivered a lecture on the bye-products of the gas industry, with special reference to coal tar and ammonia. This is held over until next week.

Mr. J. W. Napier proposed a vote of thanks to Professor Gray. The Professor's presence was, he said, a happy augury of closer interest between the gas industry and science. It was deeply to be deplored that the manufactures of our country had been largely carried on with the almost entire absence of the scientific possibilities. He was satisfied that, so far as the gas industry was concerned, its future very largely depended on the advantages it could derive from the use of science. They had to remember that the nitrogen value of coal was equivalent to a yield of 148 lbs. of sulphate of ammonia per ton, and that as only an average of 30 lbs. was obtained, or 20 per cent., the possibilities were considerable from a scientific point of view. In the shale-oil works, in changing from the horizontal to the vertical retort, the sulphate of ammonia yield was increased from about 10 to 30 lbs. In horizontal retorts, the destruction of ammonia was undoubtedly due to the thin layer of coal and the retained heat and the high temperature of the walls of the retort.

Professor Gray, in reply, said that, in making the statement that the present state of our knowledge did not point to an increased yield of ammonia, he did not mean that it was not possible to increase the figures that held at present. He pointed out that he had used the words "substantial increase." There were possibilities that the figures might be improved slightly.

A New Member.

It was intimated that Mr. Philip, of Polmont, had been received as a new member of the Association.

The Association Medal.

Mr. C. Hamilton (the President of the previous year) then presented Mr. M'Millan with the medal of the Association, in recognition of his services during the year.

Mr. M'Millan suitably replied.

The Luncheon.

Mr. Keillor, the new President, presided at the luncheon which followed, and proposed the toast of "The King."

Mr. Masterton, in proposing the toast of "The Waverley Association," said the Association was the oldest Association of Gas Managers in the country; the first meeting having been held in Kelso in August, 1861. Many notable names were inscribed on their roll of honour; and while their names might not yet have travelled far, they were worthy and estimable men in their day and generation, and contributed in no small degree to building-up the gas industry on secure and strong foundations. There was still a great deal of vitality and enthusiasm in the Association. Many of the long-standing prejudices against gas were gradually being removed from the minds of the public, and the consumers were being educated on sound and business lines regarding the many purposes for which gas could be both efficiently and economically utilized.

Mr. Keillor, who replied, referred to the presence of the oldest member of the Association, Mr. Andrew Mackenzie, and called upon him to say a few words.

Mr. Mackenzie recalled the meetings of the Association in former years. The men who attended them, he said, knew their business as gas engineers. Their watchword was retrenchment and reform. In those days they used to meet at the different works, and the meetings were of an informal nature; but they tended very much to increase the knowledge of those who took part in them.

There were songs at intervals by various members of the company.

A History of the Association.

In connection with the meeting, the Secretary (Mr. R. W. Cowie) forwards the following particulars as to its formation:

The Waverley Association of Gas Managers has the honour of being the first Association of Gas Managers in the United Kingdom. The title of the Association at once discloses the locality of its early meetings. In July, 1861, the late Mr. Robson, then Gas Manager at Selkirk, wrote to all the gas managers south of the Forth calling them to a meeting in Kelso. This meeting took place in the Queen's Head Hotel, Kelso, on Aug. 5, 1861. The late Mr. Clazy, then Manager of the Kelso Gas-Works, was placed in the chair; and Mr. Robson, who had been instrumental in calling the meeting, was appointed Secretary of the new Association. After the business of the meeting was over, the members and their wives dined together; and after dinner the first President (Mr. Clazy) took the company a walk round the town and through the beautiful grounds of Floors Castle. The second meeting took place in Edinburgh in the month of April, 1862. For many years the Association had meetings twice each year; and these were held in various towns in the Waverley district. The meetings were quite informal—there being few set-addresses or papers. They were more like round-table conferences, where everyone felt at home and took part in the various discussions with a freedom seldom seen at the meetings nowadays. For a number of years, the meetings have been held annually, and Edinburgh has been the favourite meeting place.

COAL TAR COLOUR INDUSTRY IN HOLLAND.

In an article dealing with the condition of the Dutch Chemical Industry at the beginning of the year, the "Chemiker Zeitung" treats of the proposal to found the coal-tar industry in Holland. The current issue of the "Journal of the Society of Chemical Industry" contains an abstract of the article, which is based partly on information given in a note on the economic condition of Holland published by the Dutch Government on March 31.

Sulphuric acid works have been very busy, it is said, notwithstanding difficulties in obtaining raw materials, and new works are to be erected. In superphosphate works which make their own sulphuric acid, overtime is being worked; but in other cases work has been restricted owing to the shortage of sulphuric acid. The manufacture of incandescent mantles in Holland before the war suffered greatly from German competition; but after the war broke out the industry was very prosperous for a time—largely owing to the increased trade with England—and several new works were established. More recently the position has become less favourable; and some of the new works have had to close-down, owing to the failure to obtain adequate supplies of raw materials from Germany, and to the determination of England to become independent of the Dutch product. The future of the industry is regarded as very uncertain. There are only two small coal-tar distilleries and three small coal-tar colour works in Holland, which has depended almost exclusively upon Germany for its supplies of dyestuffs. Since the outbreak of war the German Government has permitted the exportation to Holland of dyestuffs equivalent to 50 per cent. of the 1913 consumption up to October, 1915, and of 75 per cent. since that date. On Jan. 25 last, however, the German dyestuff exporters were ordered to price their goods in gulden, using the pre-war exchange value of M1·70; and this, of course, had the effect of considerably increasing the real price of the goods. As a result of a conferenee of the leading Dutch consumers of dyestuffs, an attempt is being made to deal with the question through diplomatic channels; and steps are also being taken to organize a coal-tar colour industry. A company has been formed, which will be connected with the Naarden chemical-works, and will confine itself at first to the manufacture of aniline oil. It will be financed by the Nederlandsche Handelsmaatschappij, and is assured of the support of the large consumers of dyestuffs and of the producers of raw materials. Apart from difficulties due to inadequate supplies of raw materials and of coal or other sources of power, it is pointed out that Holland lacks the requisite supply of trained chemists and experienced workmen; and it is considered that there is less probability in Holland even than in England and the United States of the establishment of a coal-tar colour industry capable of competing with that of Germany.

Openings for British Trade.—Since the outbreak of the war, applications have been received at the Commercial Intelligence Branch of the Board of Trade from a large number of firms in this country who wish to get into communication with United Kingdom manufacturers or producers of various classes of goods which have previously been obtained from Germany and Austria-Hungary. A list published in the current number of the Official Journal mentions, among the applications from firms at home, inquiries for gas-mantle rings (magnesia or fire-clay).

Gas-Heating in Electro-Plating.—The "Journal des Usines à Gaz," in its issue of June 5, describes a system of gas-heating recently adopted for electro-plating (in replacement of coal) by M. Goujat, of Paris. Each vessel containing the bath for electro silvering or gilding is heated by a set of five upright burners, consuming 500 litres of gas per hour. It is found that the rapid application and removal of the heat is of great service in this technical craft, and that the temperature of the baths can be kept very constant at about 160° Fahr. The entire absence of dust also conduces to the perfection of the work.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Gas Institution Refractory Materials Committee's Report.

SIR,—I am afraid that Dr. Colman, in his eagerness to score a debating point over me on Tuesday last, overlooked several important matters.

(1) In referring to the retort makers, I said the more important were trustworthy; and it was unnecessary to spend large sums in plant to test their productions.

(2) The retort makers are our friends, and as interested as we are in producing the best material possible, if only for their reputations' sake, and are jointly responsible for the specification.

(3) The other people referred to, as testing our products, are certainly not our friends, and rarely treat gas undertakings in a friendly spirit.

Dr. Colman's illustrations, therefore, will not bear examination; and my statement, that it is unnecessary to test every fire-brick and retort sent in to the gas-works by the best known and most reliable makers of refractory material, stands good, unless the gas undertaking is taking up research work in conjunction with the Refractory Materials Committee and the makers.

H. KENDRICK, Engineer and Manager.

Stretford Gas-Works, June 9, 1916.

Ventilating Burners and the Institution Research Committee's Report.

SIR,—While appreciating the kindness of the President in allowing me to make a few remarks last Tuesday regarding this matter, I do feel that, owing to the very few minutes at my disposal (on account of luncheon time), I did not altogether make the matter clear from our standpoint, and from experience secured in actual practice with various installations.

We find that our ventilating sun-burner, as regards discharge, varies almost in every case; and seldom do we have only a 9½-inch shaft forming the main outlet. In fact, the 9½-inch shaft is really the injector; and the shaft fitted over the grating forms the main ventilating outlet. The dimensions of this shaft are in no way limited, and are always made to suit the requirements of the building. The inner 6½-inch flue, which is designated the "injector," is for other reasons an absolute necessity of the burner; and to remove it would reduce the value in illumination, and also cause carbonization in the mantles.

In the early stages of development of our burner, tests were carried out discharging direct into a 9½-inch shaft; and only after exhaustive experiments did we arrive at the correct form and size of the inner shaft to ensure the proper working of the burner.

Trusting that these few remarks, in addition to those made through the courtesy of the Institution of Gas Engineers on this matter, may be of interest.

JAMES MILNE AND SON, LIMITED,
per W. D. HELPS, Director.

Leeds, June 8, 1916.

Gas Supply and Daylight Saving.

SIR,—You invite results of "Daylight Saving" in your last issue; and, first of all, I would venture to think that most of the results you have been favoured with are arrived at from a wrong basis.

Comparison in most cases is made with 1914 and 1915; while the conditions have varied considerably in each year.

I compared the week following and including the 21st of May (the first week of "Summer Time") with the previous week, by deducting the consumption of 5 a.m. to 5 p.m. from the total twenty-four hours—the difference being the gas used in the lighting hours.

The enclosed shows you the result—that the saving was an average of nearly 50,000 cubic feet per night.

The lower table then compares three years, and shows that this loss is compensated for on the total output.

It shows a total increase of 11·05 per cent. for 1916 over 1915; an increase of 24·7 per cent. on the day load; and a decrease of 4·85 per cent. on the night load.

I thought this method of getting the result may be of interest to your readers.

F. W. CROSS.

Lea Bridge District Gas Company, June 9, 1916.

Twenty-Four Hour Output Less the Day Output Shows the Difference in the Night Output.

													fference.
Sun.	May 14	1,273,000	24 hrs.			May 21	1,356,600	24 hrs.			
	Day load*	834,200		Night load †	438,800	Day load	956,300		Night load,	400,300	..	38,500
Mon.	May 15	1,244,600	,,			May 22	1,232,000	,,				
	Day load	646,600		Night load	598,000	Day load	692,900		Night load	539,100	..	58,900
Tues.	May 16	1,336,100	,,			May 23	1,340,700	,,				
	Day load	748,600		Night load	587,500	Day load	795,600		Night load	545,100	..	42,400
Wed.	May 17	1,392,700	,,			May 24	1,368,500	,,				
	Day load	794,700		Night load	598,000	Day load	803,600		Night load	564,900	..	33,100
Thurs.	May 18	1,368,500	,,			May 25	1,330,900	,,				
	Day load	766,000		Night load	602,500	Day load	762,500		Night load	568,400	..	34,100
Friday	May 19	1,361,700	,,			May 26	1,332,900	,,				
	Day load	726,900		Night load	634,800	Day load	783,200		Night load	549,700	..	85,100
Sat.	May 20	1,417,600	,,			May 27	1,409,700	,,				
	Day load	819,200		Night load	598,400	Day load	861,700		Night load	548,000	..	50,400
					4,058,000					3,715,500		342,500

* 5 a.m. to 5 p.m. † 5 p.m. to 5 a.m.

Average 48,900 c. ft.

COMPARISON OF WEEKS.

	1914.		1915.	Over 1914.		1916.	Over 1915.
Full 24 hours	8,174,700	..	8,438,100	+ 3·22 per cent.	..	9,371,300	+ 11·05 per cent.
Day 12 hours	4,126,900	..	4,533,100	+ 9·84 per cent.	..	5,655,800	+ 24·7 per cent.
Night 12 hours	4,047,800	..	3,905,000	− 3·5 per cent.	..	3,715,500	− 4·85 per cent.

24 Hours Increase 1916 over 1915 = 933,200 cubic feet.
Day 12 ,, ,, ,, ,, 1915 = 1,122,700 ,,
Night 12 ,, Decrease 1916 on 1915 = 189,500 ,,
,, 12 ,, ,, 2 weeks before and after May 21 = 342,500 ,,

REGISTER OF PATENTS.

Coin-Operated Meters.

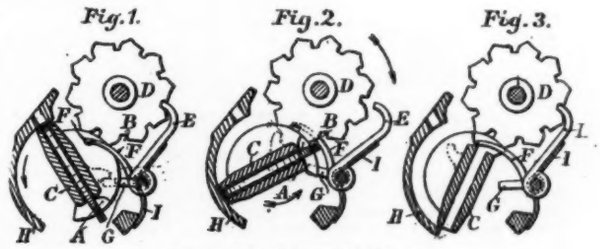
CIE. POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ, of Paris.

No. 7075; May 11, 1915. Convention date, May 12, 1914.

This invention is a modification of that described in Patent No. 20,991 of 1912, and comprises "arrangements for preventing fraud."

In the mechanism described in the 1912 specification, the segmental part of the coin projecting beyond the barrel is intended to act (like a tooth of a wheel) on a ratchet wheel, which it rotates to a given extent, after which the wheel is locked again by a pawl. This system necessitates the use of a safety device preventing the coin from being withdrawn after it has raised the pawl, and thus released the ratchet wheel, which could then be rotated and the coin recovered. This operation could, moreover, be repeated at will, and thus an indefinite quantity of gas obtained without paying for it.

It has been proposed to render fraudulent operations more difficult by making the ratchet wheel in the form of a Geneva wheel, locked by a cylindrical surface on the coin-barrel and further secured by a pivoted pawl having an arm engaged by the coin, when the barrel is rotated, so as to disengage the pawl from the Geneva wheel and allow the latter to be operated by the coil in the barrel. It has also been proposed to provide a pin on the barrel co-operating with the back of the arm of the pawl so as to lock the pawl positively while the barrel is in the coin-receiving position. According to the present invention, however, two separate arms are provided—one engaged by the coin to release the pawl, and the other, by a projection on the barrel, to lock the pawl during the coin-receiving position of the barrel.



A French Coin-Operated Meter.

The illustration shows (in cross-section) some of the parts of the mechanism of a meter constructed according to the invention—the barrel receiving the coins being in three different positions of its travel.

The cylindrical part of the barrel C engages with the teeth of the Geneva wheel D in such a manner that two of its teeth rest on the circumference of the barrel, "which thus constitutes a real lock, preventing the wheel from making any movement until it has been brought into

such a position that the recess A is opposite the tooth B." In this special position, it is obvious that the Geneva wheel, if the movement of the meter has the tendency to turn it in the direction of the arrow, will be able to execute a movement of rotation, for the tooth B can enter the recess A and drive the barrel, which movement could, moreover, be facilitated by turning the outside handle by hand.

There exists therefore a critical point at which the barrel C does not absolutely lock the wheel D, so that fraud would be possible if the wheel were completely free when the tooth comes opposite the recess in the barrel. It is therefore necessary to prevent any movement of the wheel from at the moment taking place. This result is attained by means of a pawl E, which, in the position of rest, is always in engagement with the teeth of the wheel D. The pawl is provided with an arm F arranged in such a manner that the coin, during its passage through the mechanism, when the coin is driven by the barrel, meets the arm. The pawl has also a second arm G, arranged so that the coin, when driven by the barrel, does not meet it. The end of this second arm G engages with a recess of the barrel, when the latter is in the position of rest, and prevents the pawl from being raised by the introduction of some tool into the coin-slot.

The working of the device is as follows: If, after the introduction of a coin into the barrel, the latter is turned, the movement first of all disengages the arm G (fig. 2). The coin then meets the arm F and raises it, which lifts the pawl E from the teeth of the Geneva wheel. It is thus released at the moment when the coin comes into contact with the tooth B, which is then pushed by the coin, so that the wheel rotates until the coin leaves the slope, which formed for it a point of support (fig. 3). Being then no longer supported, it is ejected from the barrel by the action of springs I which at the same time return the pawl E into engagement with the wheel D, which is thus advanced to the extent of one tooth.

As long as the coin has not completed the whole of its passage through the mechanism, it can obviously be brought back. But, the patentees remark, this manœuvre need not in any way be feared from the point of view of fraud; for if the return movement of the coin is executed during the first portion of its passage, before the pawl is raised, no movement of the Geneva wheel could take place, since it is held both by the pawl and by the engagement of the barrel with its teeth. On the other hand, if the return movement is effected in another position, it will also remain without effect in the event of a fraudulent attempt, since the wheel D will then be brought back to its original position, either by the coin itself, which acts as a tooth, or by the barrel, which drives the Geneva wheel in its return movement of rotation. In fact, the pawl E and the portion of the barrel C which engages with the wheel D constitute two distinct locks, which can be simultaneously disengaged only on the condition that a coin accompanies the barrel in its rotation; and these locks, as well as the barrel and the ratchet wheel, necessarily return to their original positions, if the coin, on arriving at any point of its travel, is caused to move back.

Gas-Engines.

GIFFORD, E. C., of Plainville, and HOLMES, E. M., of Barrington, U.S.A.

No. 9445; June 28, 1915.

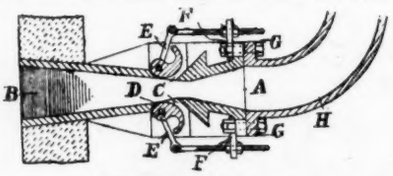
This invention has reference more particularly to four-cycle gas-engines, in which the cylinders are arranged in pairs in oppositely disposed relation to the crank-shaft, intermediate of the cylinders, and with a piston in each cylinder operatively connected with the crank-shaft with two oppositely disposed cranks. The object aimed at is to provide means for operating the valve whereby the inlet to, and the exhaust from, the cylinders in an engine will be controlled "in a more positive manner than has hitherto been the case."

Gas-Burners.—No. 100,059.

BRADSHAW, C. D., of Johnstown, Penn., U.S.A.

No. 1659; Feb. 3, 1916. Convention date, Feb. 3, 1915.

This burner (as shown) is for use with blast-furnace gas, producer gas, coal gas, or natural gas. It has a converging entrance portion A, a diverging outlet portion B, and air-inlet openings C at or near the junction of the two portions. The entrance portion has a straight throat; and the air inlets are regulated by means of valves D, mounted



Bradshaw's Gas-Burner.

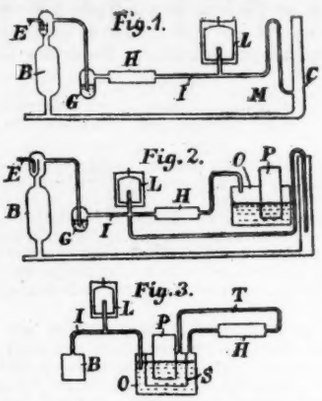
on pivots and adjusted by links E and adjusting-nuts on either side of brackets F on the burner. The burner portion is bolted to flanges G on the supply pipe H. The burner may either be flat or rectangular in section.

Gas Analysis Apparatus.—No. 100,066.

AKTIEBOLAGET INGENIORSFIRMA F. EGNELL, of Stockholm.

No. 1205; Jan. 25, 1916; Convention date, Feb. 6, 1915.

In the automatic gas-analysis apparatus shown, the absorption of oxygen is effected by finely-divided metal or a solid mass produced by sintering finely-divided metal, in a heated receptacle; and if combustible ingredients are to be burnt, this is effected by arranging a reducible metal oxide—such as copper oxide—in the rear end of the receptacle or in a separate one. The heating of the metal or oxide is preferably effected electrically; and a device for cooling and moistening the gas is inserted after the heated receptacle.



Egnell's Gas Analysis Apparatus.

In the apparatus shown in fig. 1, liquid is caused to rise and fall in a pipe-system so as to draw gas into a measuring vessel B from a pipe E, and to expel the measured volume through a seal G and heated receptacle H into the measuring-bell L, from which it is expelled through a pipe M when the level of the liquid in C falls sufficiently to uncover the end of the pipe M.

Various modifications are described for the estimation of the total proportion of particular groups of ingredients; the apparatus being varied by inserting a potash-absorbing vessel between B and H, or in front of B and between H and L. In the latter arrangement, the positions of H and B may be transposed.

In a modification, fig. 2, the pipe I leading from the measuring-vessel B branches—one branch leading direct to the bell L, and the other to the receptacle H, and thence to a vessel O having a pipe P. The motion of the bell L depends on the quantity of gas absorbed in H. Potash absorption-vessels may be inserted in this modification.

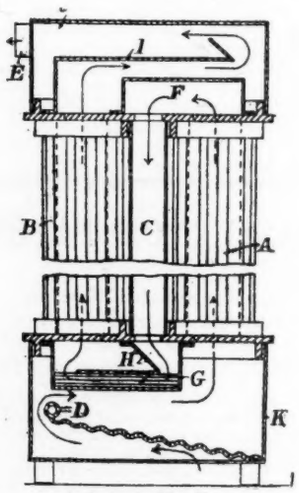
In another form, fig. 3, potash is placed in the vessel O, which is provided with an inner vessel S containing the pipe P; the vessels S and O being connected by a pipe T leading to and from the receptacle H. The vessel S may contain water, glycerine, or the like, or it may contain potash, in which case the vessel S may have an open bottom.

Gas-Stoves.—No. 100,114.

FLEISCHER, J., of Stuttgart, and HAEGELE and ZWEIGLE, of Esslingen, Germany.

No. 2749; Feb. 24, 1916. Convention date, Feb. 15, 1915.

A gas-stove constructed according to this invention comprises three groups of pipes, preferably star-section pipes A B and plain pipes C, through which the gases from the burner D pass up, down, and up again to the outlet E. The pipes A and C are connected by a chamber F, and the pipes C and B by a chamber G, in which chambers the combustion



A German Gas-Stove.

products are heated, respectively, by the flames from the burner and the gases from the tubes B. The chamber G has a fluted bottom, and forms, with the baffle H, a series of passages for the combustion gases. A baffle I conducts the gases over the heating chamber F. Flanged plates connect the tubes to the head J and the base K.

Gas-Meters.—No. 100,179.

VISSER, A. P., of The Hague, Holland.

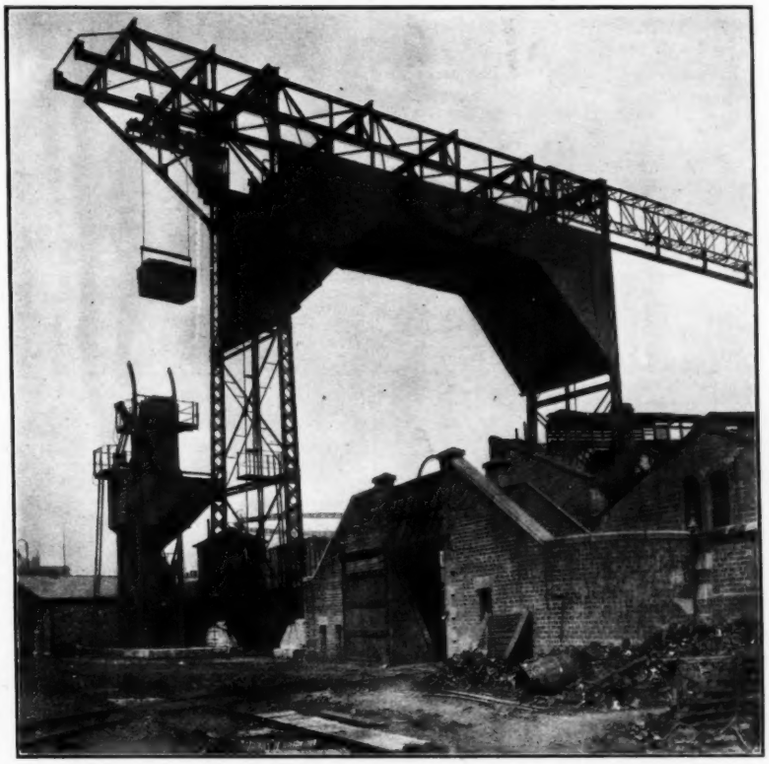
No. 3518; March 9, 1916. Convention date, March 12, 1915.

In a dry gas-meter, according to this invention, the distributing-valves—which may be loose-ball valves, or lift-valves comprising

MONO-RAIL TELPHERAGE
FOR GAS-WORKS.

TELPHER PLANT AT DALMARNOCK, GLASGOW.

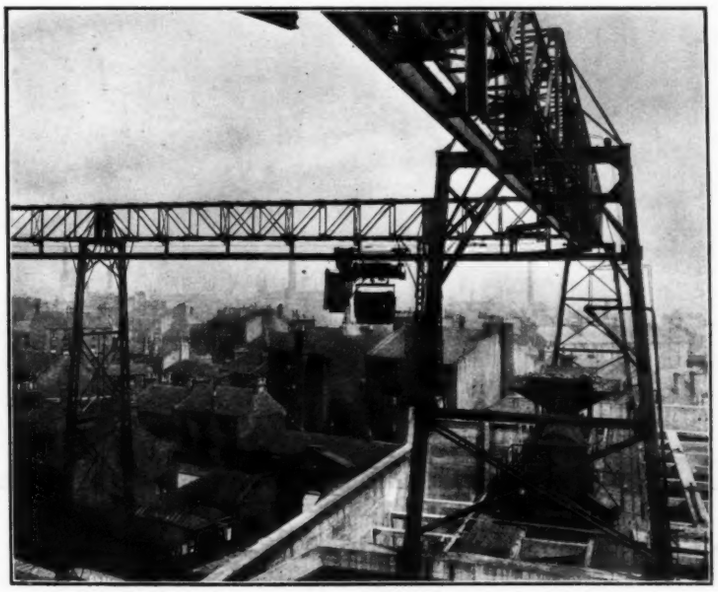
THREE TELPHERS SUPPLIED—EACH HAVING A CAPACITY OF 60 TONS PER HOUR FROM FILLER TO BUNKERS.



End View of Coal Telpher Track showing Strachan & Henshaw

3½-TON AUTO SKIP FILLER.

We are building a Duplicate Skip Filler for delivering coal to the second track which is shown in the picture.



General View of Telpher over Coke Bunkers.

HEIGHT OF TELPHER TRACK 77 FEET, LENGTH 1,200 FEET.

GROSS LOAD 4½ TONS; SPEEDS, LIFTING 90 F.P.M; TRAVELLING 600 F.P.M

TWO OF OUR PATENT QUICK-ACTION TRACK SWITCHES ARE FIXED ON THIS TRACK.

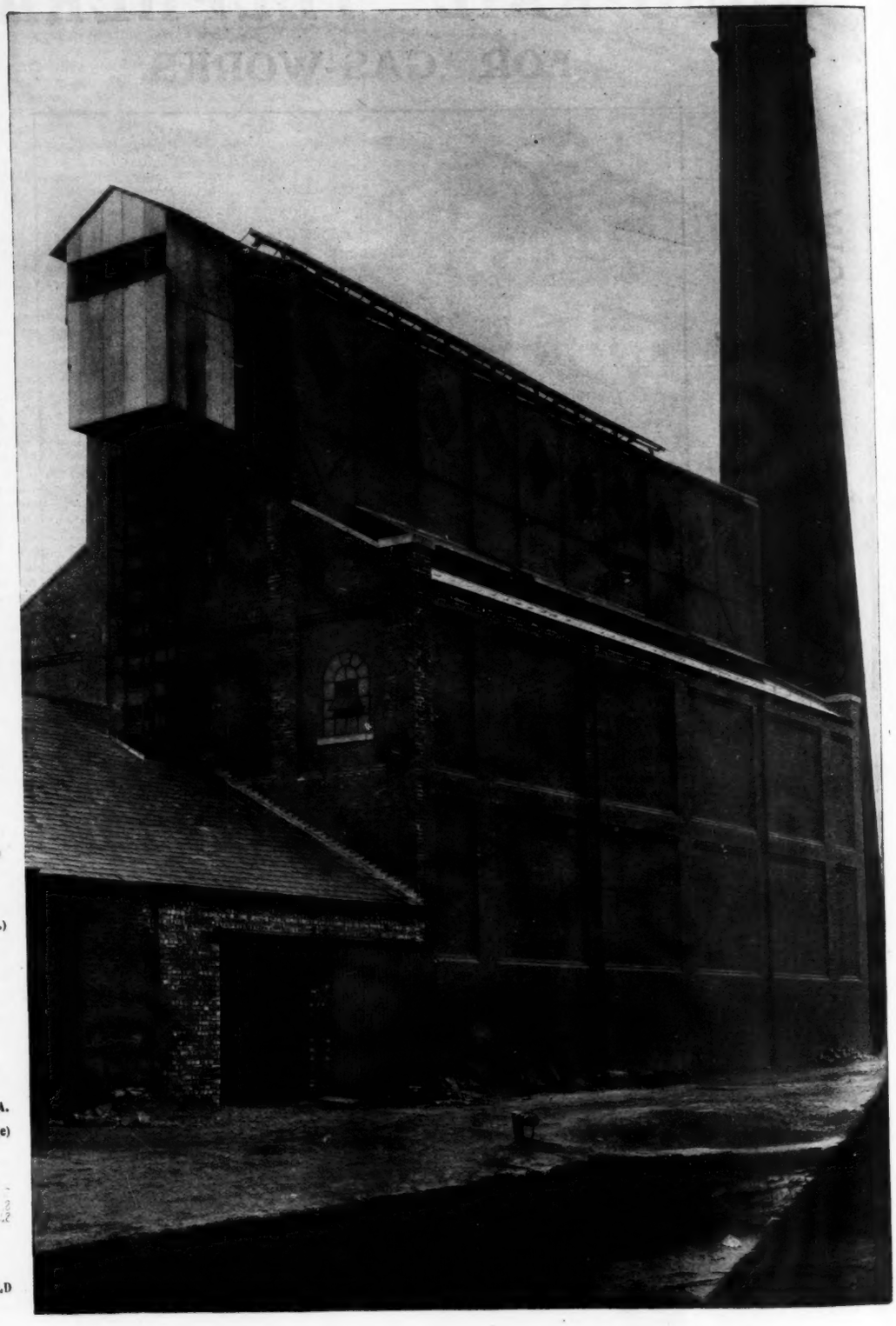
Telegrams: "STRASHAW BRISTOL." Telephone: 432 BRISTOL.

MAKERS: STRACHAN & HENSHAW, LTD., BRISTOL.

WOODALL-DUCKHAM INSTALLATION AT HYDE.

Plants Erected and in Course of Erection.

BOURNEMOUTH
POOLE
LONDON (Nine Elms)
LONDON (Kensal Green)
BURNLEY
LAUSANNE
LUTON
LA GRANGE, U.S.A.
DRESDEN
IPSWICH, Queensland
POOLE (II.)
SMETHWICK
HULL
DERBY, U.S.A.
TOTTENHAM
BUDAPEST
YOKOHAMA
LUTON (II.)
BIRMINGHAM (Windsor St.)
" (Nechells)
SPALDING
STRANDVEI, Denmark
HOLYOKE, U.S.A.
BIRKENHEAD
BRISTOL
CLECKHEATON
KINLOCHLEVEN
TOULOUSE
WEST BROMWICH
MARGATE
HYDE
IPSWICH
BOLTON
ABERDEEN
DERBY, U.S.A. (II.)
POOLE (III.)
SMETHWICK (II.)
NICE
WANGANUI, N.Z.
SCHENECTADY, U.S.A.
BROCKTON, U.S.A.
NEW HAVEN, U.S.A.
GREENOCK
AYR
MARSEILLES
MONTBELIARD, France
DUNDEE
ST. ETIENNE, France
SOUTH SHIELDS
WALLASEY
LONDON (Kensal Green) (II.)
KENDAL
IRVINE
ROWLEY REGIS
HAMILTON
HARROGATE
TUNIS
BRENTFORD
CANNOCK
PRESCOT
GLOSSOP
WORKINGTON
HULL (II.)
NORMANTON
MESSENA SPRINGS, U.S.A.
BIRMINGHAM (Swan Village)
BRADFORD
MELBOURNE
BERGEN, Norway
TRONDHJEM, Norway
ELLESMERE PORT
TOTTENHAM (II.)
PORTSEA ISLAND
NEWTON-ON-AYR
FORFAR
NOTTINGHAM
CUPAR
NEWTON-IN-MAKERFIELD
STRANDVEJ (II.)
ODENSE



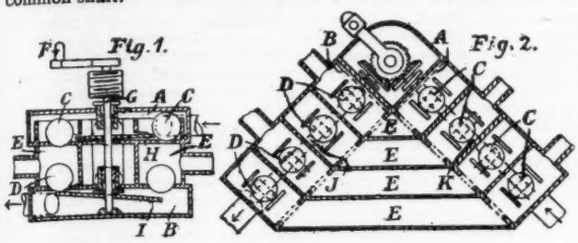
Extract from the "JOURNAL" for May 16, 1916.

"The new vertical retort installation was now working to its fullest capacity, and giving every satisfaction. Under this system of carbonization, the yield of gas per ton of coal had greatly increased; and the tar and ammoniacal liquor had both increased in quantity, and the former much improved in quality and strength."

The WOODALL-DUCKHAM VERTICAL RETORT and OVEN CONSTRUCTION COMPANY LTD.

Palace Chambers Westminster S.W.

bodies provided with guided tails—are operated directly by eccentric discs, obliquely-set plates, cam-plates, &c., preferably mounted on a common shaft.



Visser's Gas-Meter.

In the form shown in fig. 1, the valve-box comprises a supply chamber A, and discharge chamber B, each provided with four valves C D controlling four distributing-chambers E corresponding to the measuring-chambers of the meter. The diaphragms are connected through a crank F to a shaft G, on which are mounted an eccentric disc H and obliquely-set plate I for actuating the valves C D.

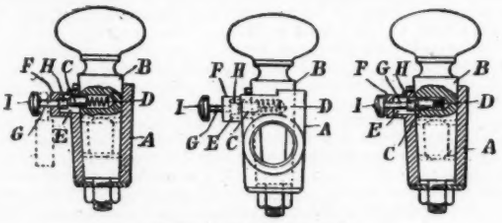
In modifications described, both sets of valves may be actuated by oblique plates, or the valves may be arranged as shown in fig. 2 and moved by eccentrics on the shafts J K.

Taps or Cocks—No. 100,419.

STIMSON, E. F., of Tooting Bec Common, S.W.

No. 2007; Feb. 10, 1916.

This invention relates to taps or cocks (chiefly for use with gas cooking-stoves) of the kind in which the plug cannot be turned from the off position without the prior inward displacement by hand of a push-button stem protruding radially from the barrel, which displaces inwardly a spring-urged plunger (in the plug and engaging a recess in the barrel) which prevents the accidental turning of the plug from such position. The stem for displacing by hand the plunger back into the plug so as to unlock the latter is unconnected with the plunger and does not rotate with the plug, but is capable of radial displacement only in the wall of the barrel within which it extends to the recess.



Stimson's Gas-Stove Cock.

E is a radial recess in the wall of the barrel A, opposite which the plunger C comes when the plug B is in the position to cut off the gas. When in such position, the spring D forces the plunger outwards to protrude into the recess E, whereby the plug is locked against rotation. The recess extends into a lateral boss F on the barrel, through which is guided a sliding stem G, with a head H within the recess and a push-button I at its outer end. By pressing inwards this push-button, and thereby also the stem and head, the plunger is forced into the plug against the influence of the spring D, thereby unlocking the plug and permitting its being turned.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for June 7.]

Nos. 7573—7906.

CANNON IRON FOUNDRIES.—"Gas-injector nipples for atmospheric burners." No. 7628.
CUSACK, T.—"Atmospheric gas-burners." No. 7773.
HARRIS, J. H.—"Igniting gas in engines." No. 7679.
HAWTHORNE, H. S.—See Cannon Iron Foundries. No. 7628.
HENSON, W. J.—"Gas and oil stoves." No. 7841.
JENKINS, F. T.—"Valves for reducing pressure of gases." No. 7637.
LAWTON, W. A.—See Henson. No. 7841.
PULMAN, W.—"Gas-heated apparatus for grilling or cooking, for heating water, and for use as a gas-fire and radiator." No. 7627.
WEBB, C. R.—"Parallel slide stop-valve." No. 7862.
WHITFIELD, C.—"Gas-producer plant." No. 7759.

RESTORATION OF LAPSED PATENT.

Notice is given that an order was made on May 31, 1916, restoring the letters patent granted to WILLIAM WHITE for an invention entitled "Improvements in gas-stoves," No. 23,033 of 1910; Oct. 5, 1910.

Loughborough Gas Supply.—A continued decrease is reported in the use of gas at Loughborough; the figures for April showing that the consumption as compared with last year was down 833,000 cubic feet, or 16·59 per cent. The lighting order is mainly responsible for the accelerated rate of decrease.

LEGAL INTELLIGENCE.

THE LEISTON LIGHTING CONTRACT APPEAL.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Friday, June 9.

(*Before the* LORD CHIEF JUSTICE, *Lord Justice* WARRINGTON, *and Mr. Justice* SCRUTTON.)

Leiston Gas Company, Limited, v. Leiston-cum-Sizewell Urban District Council.

Judgment was given to-day in the appeal by the defendants from the judgment of Mr. Justice Low of Feb. 1 last. A report of the proceedings at the hearing of the appeal was given in the "JOURNAL" for May 30 (p. 464).

The Judgment.

The LORD CHIEF JUSTICE said: The plaintiffs sued the defendants for three quarterly payments due at March 31, June 30, and Sept. 30, 1915, respectively, under a contract in writing made between the plaintiffs and defendants, and dated June 2, 1911. The defendants denied liability, on the ground that the contract had become impossible of performance, or, alternatively, that the plaintiffs had not performed the services to be rendered in consideration of the quarterly payments. The action came for trial before Mr. Justice Low, who gave judgment for the plaintiffs for the amount claimed. The defendants appeal, and ask that judgment should be entered for them. The plaintiffs are a Gas Company, and the defendants are the Local Authority for the district of Leiston. By a memorandum of agreement between the parties it was agreed: (1) That the contract should be for five years, dated from Aug. 1, 1911, and to remain in force until determined by either party giving six calendar months' notice expiring on July 31, 1916, or July 31 in any subsequent year; (2) that the plaintiffs should provide 105 column lanterns and burners, and connect them to their mains by Aug. 1, 1911—the plant to remain the property of the plaintiffs; (3) that during the continuance of the agreement the plaintiffs should supply gas, and light, extinguish, clean, repair, paint, and maintain the lamps; (4) that the defendants should pay to the plaintiffs £1 7s. 6d. per lamp per annum for each of the 101 lamps extinguished at 11.15 p.m., and £3 7s. 6d. for each of the four lamps burning all night; the payments to be made in equal quarterly instalments. By an order made under the Defence of the Realm regulations by the competent Military Authority for the purpose of darkening the streets at night owing to the exigencies of war, none of the lamps except 26 were lighted during the first 26 nights of the first quarter. Thereafter, during the remainder of the quarter, and the two succeeding quarters, the Military Authority decided that the streets must be in complete darkness, and issued an order forbidding the lighting of any lamps; and none were lighted. The defendants contend that the contract must be regarded as one made for the public lighting of the district, and that as the Military Authority prohibited the lighting of the lamps for this purpose, the contract became impossible of performance—first, because its performance would be unlawful, and, secondly, because the object of the venture was frustrated, or, to adopt the language sometimes used, the foundation of the contract had gone. There is no doubt that when a party contracts to perform an act, lawful at the time of the making of the contract, which thereafter becomes impossible of performance by reason of a change in the law, he is discharged from his obligation under the contract [*Baily v. De Crespigney*, 1869 L.R., 4 Q.B., 180]. Again, the law is well settled that where the performance of the contract becomes impossible by the cessation of the existence of the thing which is the subject-matter of the contract, the contract is to be construed as "subject to an implied condition that the parties shall be excused in case, before breach, performance becomes impossible from the perishing of the thing, without default of the contractor" [per Blackburn, J., in *Taylor v. Caldwell*, 1863, 3 B. & S., 826, p. 833]. This principle is not confined to the cessation of the existence of the subject-matter of the contract, but applies equally "to the cases where the event which renders the contract incapable of performance is the cessation or non-existence of an express condition or state of things going to the root of the contract" [*Nikoll v. Ashton*, 1901, 2 K.B., 126, and *Krell v. Henry*, 1903, 2 K.B., p. 745]. Another well-known illustration of this principle of the Common Law is that of the charterer of a vessel who was excused from the obligation of loading her on the ground that the delay in the arrival of the vessel had made the stipulated voyage commercially impossible, and, consequently, had frustrated the object of the venture [*Jackson v. Union Marine Insurance Company*, 1874, L.R., 10 C.P., p. 125]. The law upon this subject was considered recently in the House of Lords in *Horlock v. Beal* [1916, A.C., 486], and was summarized by Lord Wrenbury, who said: "Where a contract has been entered into, and by a supervening cause beyond the control of either party its performance has become impossible, I take the law to be as follows: If a party has expressly contracted to do a lawful act, come what will—if, in other words, he has taken upon himself the risk of such a supervening cause—he is liable if it occurs, because by the very hypothesis he has contracted to be liable. But if he has not expressly so contracted, and from the nature of the contract it appears that the parties from the first must have known that its fulfilment would become impossible if such a supervening cause occurred, then upon such a cause occurring both parties are excused from performance. In that case a condition is implied that if performance becomes impossible the contract shall not remain binding." It is often difficult, when applying the principle above stated, to determine on which side of the line the particular case falls. The decision in this case must depend on the true effect of the contract. Under the memorandum of agreement the plaintiffs undertook to perform various services for the defendants, in return for an agreed rate of payment, to be made quarterly by the defendants for every quarter in the five years' duration of the contract. These services included

the provision and erection and maintenance of the column lamps and other plant for the supply of gas as stipulated; and the defendants agreed to make these payments extending over five years as the remuneration to the plaintiffs, not only for supplying and lighting the gas for the lamps, but also for providing and erecting and maintaining the plant. In fact, the plaintiffs had performed the various services under the contract for nearly three-and-a-half-years before the event under discussion happened. The column lamps remain their property under the contract, and the defendants have had the advantage of them throughout the three-and-a-half years. They have used them even in the three quarters of 1915—not, indeed, to the full extent, as the lamps were not lighted except for the 26 days of the first quarter, but to the extent that they remained there connected with the main and would be lighted immediately the prohibition by the Military Authority was relaxed or withdrawn. Upon these facts, I cannot hold that the performance of the contract had become unlawful, or that the venture was frustrated by the act of the Executive in forbidding the lighting of the lamps. Part of the performance of the contract had become unlawful, but another part of the contract, which cannot be regarded as a trivial part, was lawful and could be performed. In these circumstances, the defendants are not justified in treating the contract as at an end, or in refusing to make the payments as agreed by them. The defendants further contend that the supply of gas and the lighting of the lamps is a condition precedent to the plaintiffs' right to recover the quarterly payments. The answer to this contention depends upon the intention of the parties, to be collected from the instrument and the circumstances legally admissible in evidence with reference to which it is to be construed. [Per Parke, B., in *Graves v. Legg* [9 Ex., p. 716], and quoted by Blackburn, J., in *Bettini v. Gye* [L.R., 1 Q B.D., p. 186.] The observations I have already made upon the facts of the present case demonstrate that, in my judgment, this alternative contention of the defendants must fail. It was not intended that the supply of gas should be a condition precedent to the right to recover the quarterly payments. Under the agreement there is an inclusive payment for all the services; and the consideration cannot be apportioned. The parties might have agreed the payment for each service; but they have preferred to agree to quarterly payments for the whole service extending over five years. Baron Parke, in the case of *Graves v. Legg* [9 Ex.], states the well-acknowledged rule of law that "where a covenant or agreement goes to part of the consideration on both sides, and may be compensated in damages, it is an independent covenant or contract." I hold that the agreement by the plaintiffs to supply the gas is to be regarded as an independent agreement and not as a condition precedent. The defendants have received part of the consideration; and if the plaintiffs had been in default, the defendants could have recovered compensation for the failure to supply the gas and light the lamps. [See Notes to *Pordage v. Cole* (Williams' Notes to Saunders, 6th Edition, p. 320 *e*).] The plaintiffs were not in default, and therefore the defendants cannot recover on a cross-claim for damages; but as the supply of gas by the plaintiffs was not a condition precedent to the right to recover, the defendants cannot justify their refusal to make the quarterly payments under the contract. Accordingly, I come to the conclusion that this appeal should be dismissed.

Lord JUSTICE WARRINGTON: The plaintiffs are a Gas Company. They sue the defendants, an Urban District Council, for three quarterly payments due under a contract made in 1911 for the lighting of the Council's district. The defendants contend that, owing to the action of the Military Authority in forbidding the lighting of street-lamps in their district, they are discharged from their liability to pay. The learned Judge has rejected the defence. The defendants appeal. The defendants' principal contention—and, as I think, the only one capable of being put forward with any prospect of success—was that the lighting of their district having been rendered illegal, the foundation of the contract is gone, and the object with which it is made is entirely frustrated, with the legal consequence that the contract is avoided and each party discharged from his obligations thereunder. If the defendants could establish in fact the destruction of the foundation of the contract or the entire frustration of its object, the legal consequence would, in my judgment, follow. The real question I think is, Are the necessary facts established in this case? The material facts are as follows: The defendants are an Urban District Council having power as such to contract for the supply of gas or other illuminating medium for the lighting of their district, and to provide the necessary apparatus. Plaintiffs are a Gas Company established in the district. By the contract, which was dated June 2, 1911, the defendants agreed to make a five years' contract with plaintiffs dating from Aug. 1, 1911, and remaining in force until determined by either party giving six calendar months' written notice expiring on July 31, 1916, or on July 31 of any subsequent year. The plaintiffs undertook to provide the specified lanterns and burners, and connect the same to their mains by Aug. 1, 1911. The whole of the plant for public lighting was to remain the property of the plaintiffs. The plaintiffs were during the continuance of the agreement to supply gas, light, extinguish, clean, repair, paint, and maintain the lamps, including the provision of incandescent mantles and chimneys as required. The defendants were to pay to the plaintiffs £1 17s. 6d. per lamp per annum for each of 101 lamps extinguishable under the agreement at 11.15 p.m., and £3 7s. 6d. per lamp per annum for each of four lamps burning all night—payments to be made in four equal quarterly instalments of £50 14s. 4d. By clause 10, certain penalties were imposed in case of failure to light any lamps unless the failure were due to circumstances beyond the plaintiffs' control; and provision was made for reduction *pro ratâ* of the annual payment if the plaintiffs should be delayed in starting the lamps on Aug. 1, 1915. Plaintiffs duly provided the lamps and other apparatus, and for about three-and-a-half years performed their other obligations under the contract. In the quarter ending March 31, 1915, however, the competent Military Authority, acting under the regulations for the Defence of the Realm, very considerably reduced the lighting of the district, and for the quarters ending June 30 and Sept. 30 prohibited it altogether. There are certain points to be noted about the contract. The plaintiffs undertake the whole of the matters incident to public lighting—that is to say, the provision and maintenance of the lamps, their connection with the main, involving the supply of gas and the maintenance and cleansing of the appliances, including the due supply of burners and so forth. For this they are to be paid an annual sum by equal quarterly payments. The sum is measured by the number of lamps, and is uniform for them all, with the exception of four which burn all night. It is an annual sum payable by equal quarterly payments—that is to say, not by payments varying according to the quantity of gas likely to be consumed in each particular quarter. It covers, and is the remuneration for, the entire service to be performed by them, and no particular part is attributed to any particular item of the service. It follows, I think, that failure to supply in a particular quarter any one of the items would not be a condition precedent to the recovery of the quarterly payment. But if such failure amounted to a breach of contract, the remedy must be in damages. The contract cannot be divided into a number of quarterly contracts. If the contract then remains subsisting, the defendants cannot, in my opinion, rest their defence on the failure of the plaintiffs during the periods in question to light the district in the manner contemplated by the contract. But the contention is that the contract has been avoided altogether, and both parties are discharged from their obligations, as the result of what the defendants say is the destruction of the foundation of the contract, or, to put the same idea into other words, the entire frustration of its object. Whether this event has taken place is a question of fact, and must, I think, be answered in the negative. The effect of the action of the executive is to render unlawful, so long as the present orders remain in force (which may be for the continuance of the war or a shorter period), the lighting of the street-lamps. This renders impossible of performance only one of the services provided for by the contract—namely, the actual lighting and extinguishing of the lamps. It is still lawful for the plaintiffs to perform, and they remain bound to perform, all their other obligations, including the maintenance of the connection of the lanterns with the mains, whereby the supply of gas could be at once resumed as soon as the prohibition is wholly or in part removed. Looking at it from another point of view, it may be said that the plaintiffs are able and willing to, and do in fact, keep up the supply of gas, but by the action of the authorities the defendants are prevented from making use of it when applied. Moreover, for three-and-a-half years the defendants have had the benefit of the entire services contracted for, including the expenditure of money in providing plant. The parties have not thought fit to provide a separate charge for the supply of gas, but have chosen to adopt an inclusive payment. In these circumstances, I find it impossible to come to the conclusion that the foundation of the contract has been destroyed or its object frustrated. No doubt the public lighting is for the time in abeyance; but this is not, in my opinion, enough to avoid altogether such a contract as the present, with the result of relieving the defendants from making a payment a large part of which at all events must have been earned. I think the inability to enjoy all they pay for is a loss which must fall on the defendants. In my opinion, the judgment of Mr. Justice Low was correct, and ought to be affirmed. I now propose to read Mr. Justice Scrutton's judgment.

Mr. JUSTICE SCRUTTON: An action was brought by the Leiston Gas Company against the Leiston Urban District Council to recover £157 15s., being three quarterly payments due from the Council under an agreement dated June 2, 1911. The defendants alleged that the agreement was for the supply of lighted gas-lamps, and that, under orders from a competent Military Authority acting under the Defence of the Realm Act, such lamps could not be lighted for more than half the first quarter, and for the whole of the second and third quarters sued for. Mr. Justice Low held that this was no defence, and gave judgment for the plaintiffs—the Gas Company. The defendants, the Council, appeal to this Court. The case raises questions of general importance and some difficulty. It is necessary, first, to appreciate exactly what the agreement sued under provides. It is a contract to last for five years from Aug. 1, 1911, and thereafter till determined by six months' notice terminating on July 31 of any year after and including 1916. The Gas Company are to provide 105 gas-standards and burners with automatic lighters, which remain their property, and to connect them with their mains, and to supply gas and incandescent mantles and chimneys for, and light, extinguish, clean, repair, paint, and maintain the said lamps. The lamps are to be lit every night between certain hours, varying with sunset and sunrise, except on bright moonlight nights. The Council are not to pay in proportion to gas supplied, but pay an annual rate for each of the lamps contracted for, reduced on a scale if the Company reduce their charge for gas. The annual sum is payable quarterly. The quarterly payment, therefore, does not immediately depend on the gas supplied; it is the same in the winter and summer quarters, and the same whether the quarter contains many or few bright moonlight nights. It includes an unapportioned sum for supply and maintenance of plant. The Company are liable for damages or penalty (both words are used) for each lamp they fail to light on any night when it ought to be lit, unless the failure is due to circumstances beyond their control; and the parties provide that if there is delay in starting the lamps on Aug. 1, 1911, the penalty shall not apply, but the quarterly payment shall be reduced *pro ratâ*. They make no express provision for any reduction from the quarterly payment in case of failure to light from causes beyond the Gas Company's control; nor do they say whether the Company are to suffer a reduction of payment as well as damages in the case of failure to light from causes within their control. At first sight it is very tempting to say: "This is a contract to provide illumination, and the person who does not provide illumination cannot ask to be paid for it." But when the consequences come to be more closely looked into, it is not so easy to follow them. The Gas Company supply lighted gas for half the first quarter; are then prevented, by causes beyond their control, from supplying lights till the middle of the second quarter, when the impediment is removed, and the supply of light recommences. What is the consequence? Can the Council refuse payment for the first quarter, and for the second quarter, because a full quarter's gas is not supplied in either case? But does the contract remain in existence; the Company being bound to go on as soon as the impediment is removed? Or is there to be an apportionment of the quarters' payments according to the time during which lighted gas is supplied; the time of darkness being written out of the contract? Does the contract come to an end

when the supply of lighted gas has ceased for so long a time as to go to the root of the contract, to adopt the language of Mr. Justice Blackburn in *Bettini v. Gye* [1 Q.B.D., p. 187], citing with approval Baron Parke in *Graves v. Legg* [9 Ex., p. 716], or to defeat the commercial purpose of the adventure, in the language of Baron Bramwell in *Jackson v. Union Marine Insurance Company* [L.R., 10 C.P., p. 125]. The attempt to answer these questions suggests that the Court may really be being asked to make an agreement for the parties in a matter which they have not thought of, or expressly dealt with. Since the time of *Paradine v. Jane* [Aleyn, p. 26; see also per Mr. Justice Willes in *Clifford v. Watts*, L.R., 5 C.P., p. 586], when the question was discussed whether a loyal Englishman need pay rent to his landlord when the house he rented had been destroyed by the King's enemies, the "wild Scots," the distinction has been taken between duties or charges imposed by the law where the party cannot perform it by events occurring without any default in him, in which case he is excused by the impossibility, and duties created by the agreement of the party, when he is "bound to make it good, notwithstanding any accident by inevitable necessity, because he might have provided against it by his contract." Since then the Courts have steadily refused to make contracts for parties which they might have, and have not, made for themselves, unless the term is so obvious and necessary that it must be implied as a matter of business in such a contract. [The Morscock, 14 P.D., p. 68]. It is said that the supply of lighted gas has become illegal. This is true for an uncertain time. At any moment the illegality may be removed by peace, or changed conditions of war. But the payment of the quarterly sum has not become illegal, and part of it is not for light supplied, but for plant which has been supplied and of which the Council has had the benefit. To excuse themselves from breaking the contract to pay not being an illegal contract, the Council must, I think, satisfy the Court of one of two things. Either they must establish that the performance of the contract to supply lighted gas is a condition precedent of the necessity to observe the contract to make a quarterly payment, so that the two contracts are "dependent" and not "independent," to use the language of *Pordage v. Cole* [1 Williams Saunders' Reports, p. 549] and of Lord Mansfield in *Kingston v. Preston*, cited in *Jones v. Darkly*. [Douglas's Reports, p. 689] In such a case the Company, not having supplied lighted gas for the whole of three quarters respectively, cannot sue for payment, or the Council must satisfy the Court that though a mere failure to supply lighted gas for a short time will not relieve them from payment. There is in this case such an extensive and permanent failure to supply as "goes to the root of the matter, so that the performance of the rest of the contract by the plaintiffs is rendered a different thing in substance from what the defendant has stipulated for." [Mr. Justice Blackburn in *Bettini v. Gye*, 1 Q.B.D., p. 187.] First, can it be said that any failure to supply lighted gas, beyond these trifling failures to which the maxim "*de minimis*" might apply, prevents the Company from recovering payment in respect of the quarter in which the failure occurs? Counsel for the defendants, I think, argued that it was so; and though I consider they argued that a subsequent acceptance by the Council of lighted gas after the failure might waive the breach, they, as I understand them, contend that a fortnight's or a month's failure not waived in this way annulled the whole contract. I cannot take the view that such a failure, by itself, annuls the contract, or that the contract might be treated as twenty quarterly separate contracts one of which might be cancelled or blotted out, while the rest remained. The payment is a flat-rate payment, not a payment by meter for gas supplied; and it includes something for plant supplied and still available. For certain kinds of failure to supply light the parties have provided a remedy in damages, and in other cases a deduction from the quarterly payment. They have not expressly provided for the case of a failure to supply light owing to causes beyond the Company's control; and I do not think the Court ought to make such a contract for them, when the consideration for the payment claimed has not wholly failed. But there remains the question whether, though a mere failure to supply will not by itself be sufficient to relieve from payment, a failure of such a lengthy and permanent character as substantially to alter the mode of performance of the contract will have this effect and terminate the contract. I think this must be so, even if the contract is one for a fixed time. I put to the Counsel concerned the case of an Act of Parliament being passed after the agreement had been in operation for a quarter, prohibiting lighting the gas for four years, and asked whether the agreement would remain alive, or would be in force for the last nine months only when the operation of the Act had ceased. I think the agreement would be annulled for the reason that a supply of gas for a year in two broken periods would be a totally different thing from the five years' supply which the Council bargained for, and that the obligation to supply gas for three months, and again four years later for nine months, for four quarterly payments, would be a totally different contract from that which the Company entered into. If this principle is granted, the question is then one of fact. Was the period from the first total failure to supply on Jan. 26 to the issue of the writ on Nov. 10—that is, 9½ months—sufficient to annul a contract which is to last for at least five years, perhaps more, of which the Council has already had the benefit for three-and-a-half years? These questions of degree are always difficult; but treating it as a question of fact, I should hold that there had not at the issue of the writ been sufficient change of character in performance to destroy the contract. For these reasons, I arrive at the same result as Mr. Justice Low, and think that the appeal should be dismissed with costs.

Mr. GODDARD: My Lord, the appeal will be dismissed with costs.

The LORD CHIEF JUSTICE: Yes.

A WATER SUPPLY DISPUTE.

COURT OF SESSION.—Edinburgh, June 2.

(*Before* LORD HUNTER.)

Judgment was given to-day in an action by one Dickson, the proprietor and occupier of a farm at Lesmahagow, against the District Committee of the Upper Ward of Lanarkshire, as the local authority within the Lesmahagow Special Water Supply District. The pursuer sought declarator of the defenders' statutory obligations to provide water to the inhabitants in their district, and to him in particular; and he claimed damages in respect of their having cut off the water supply to the farm. The defenders supply the district with water for domestic and other purposes; the chief non-domestic requirement of the district being for stock and agricultural purposes. The pursuer had an agreement with them for the supply of water; but in November, 1914, he cancelled the agreement. Negotiations then took place between the parties as to the terms on which the defenders would supply the pursuer with water for other than domestic purposes, and pursuer wrote that he was prepared to pay for the water he used on the farm on condition that when he put in a meter he should be relieved of all water assessments. The defenders replied that this would be unfair to occupiers who were tenants. The pursuer did not come to any agreement with the defenders as to the meter-rate; and in April last year the defenders intimated to him that, as he was not prepared to enter into such an agreement, he would from May 15 be entitled to draw water for domestic purposes only. The pursuer appeared to have continued to use the water for other than domestic purposes; and on Sept. 15 the defenders cut off the whole supply to the pursuer's property and premises.

Lord HUNTER, in dismissing the declaratory conclusions, and continuing the case *quoad* the other conclusions, said that the pursuer's contention really amounted to this, that his premises in the matter of the supply of water were entitled to preferential treatment over premises where the owner was not in occupation. For such a contention there was no warrant, either in the Statutes or in previous decisions. The pursuer wanted to be supplied with water for other than domestic purposes—not at a price mutually agreed upon, but for the price which he was willing to pay.

Leave to reclaim was granted.

Liability for Sub-Tenants' Gas Accounts.

In the local County Court, before his Honour Judge O'Connor, K.C., Frederick Keynton, of the Black Dog Hotel, Broadmayne, was sued by the Weymouth Consumers' Gas Company for the sum of £8 11s. 5d., balance of gas account in respect of defendant's house at Rodwell. Mr. G. P. Symes, for the Company, said they were suing Mr. Keynton for gas from Sept. 30, 1913, to May 18, 1915. A certain sum had been paid on account, and they were suing him for the balance; but Mr. Keynton said they must claim from the people who took the house furnished. The whole of the accounts were sent to Mr. Keynton, and the receipts were given in his name. The Company had always refused to take any sub-tenant's name at all; and unless the tenancy was entirely changed, they charged the occupier. If any sub-tenant paid anything at all, it was always credited to Mr. Keynton. Sidney John Hatton, collector for the Company, said that the accounts sent out were always debited to Keynton; and they were never notified of any change in the tenancy. Mr. Keynton stated that he was the owner of the house, which was occupied until 1913 by Mr. Riddle. In 1913, the Rev. Medcalf went in for six months; and he informed Mr. Masters at the Gas Company's office of the change of tenancy. Since that period some of the people who had lived in the house paid for the gas. The amount claimed was not in respect of one continuous tenancy, but was spread over the tenancies of various persons. When people were going out of the house they went to the Gas Office and asked that they should take the meter in order that they should pay the money. Cross-examined by Mr. Symes, he admitted paying for gas-fittings, mantles, &c., and that he was liable for the fittings. Mrs. Keynton said she gave notice to the Company of any change of tenancy. The Judge: If you let the house to a succession of migratory paupers do you say the Gas Company has to look to them for the gas money? Mr. Symes called Ernest Henry Masters, the Manager in the outer department of the Gas Company, who said he never agreed with Mr. Keynton to change the name to any other tenant. The name of an occupier was never altered in the case of lodgers. Every demand note was sent out in Mr. Keynton's name. The Judge said the case was wholly unprecedented. He gave judgment for plaintiffs for the amount claimed. Defendant asked for six months for settlement, but the application was refused.

Fatal Gas Explosion at Birmingham.—Yesterday week, one man was killed and three others were injured as the result of an explosion which occurred at a wholesale clothing factory in Copperfield Street. Four employees had entered the premises to start work for the day; and on one of them striking a match, there was a terrific explosion—a quantity of gas having accumulated in the room from an escape in a pipe. The fire which followed was quickly got under.

Lighting Comedy at Chichester.—The street lighting of Chichester under the prevailing conditions was characterized as a farce at the meeting of the Chichester City Council last Friday week. One of the Councillors, Mr. W. Butler, asked for information regarding the street lighting of the city. The lamps were, he said, lighted in broad daylight and put out in daylight. It was altogether a farce; and he urged that the Electric Light Company should meet the Council as there would be no expense to the Company, while the lighting was no use to the inhabitants. Mr. Aylmore: The answer to that is very brief indeed. I can only say that the wording of the contract entered into after the outbreak of war entirely stops it. I do not think there is any breaking-away from the contract entered into. The Town Clerk, on being appealed to for advice, said that if the Council had no lamps at all, they would still have to pay £600 a year. There was an idea that an order stopping public lighting would be effective in freeing them from the terms of the contract. They had that view before they had their eyes open. Since that time there had been a decision in favour of a gas company. There was no getting out of it. The Mayor: At any rate, we appreciate the sunlight better than we do the electric light. [Laughter.]

MISCELLANEOUS NEWS.

NEWCASTLE GAS BILL.

Opposition in the House of Lords Withdrawn.

A report with reference to the Parliamentary Bill of the Newcastle-upon-Tyne and Gateshead Gas Company, by the Town Clerk (Mr. A. M. Oliver), was submitted, and adopted, at a meeting of the City Council last Wednesday.

The report stated that the advice of experts had been obtained upon the proposals in the Bill, and negotiations had taken place with the Company. It should, it was pointed out, be primarily remarked that, with modern methods of gas illumination, and in view of parliamentary precedent, the substitution of a heat-giving standard of gas for a light-giving standard cannot now be opposed; and a Bill is at present before Parliament, which, if it becomes law, will confer on gas undertakings generally throughout the United Kingdom the power, with the consent of the appropriate Government Department, to substitute a heat-giving for a light-giving standard.

Terms had been submitted which the Company were prepared to accept, subject to the withdrawal of the Corporation's opposition, and without prejudice to the position of the Company as promoters of the Bill if they are not accepted by the Corporation.

To save further expense to the Corporation in preparing briefs, retaining Parliamentary Counsel, and otherwise, the petition in the House of Lords has been withdrawn, in view of the willingness of the Company to come to a settlement, without prejudice, however, to the right of the Corporation, if necessity arises, to petition in the Lower House.

THE COLCHESTER GAS BILL AND THE PROPOSED PURCHASE CLAUSES.

At their meeting last Wednesday, the Colchester Town Council (in committee) received the following report from the Special Committee on the Colchester Gas Bill.

The Committee report that, under the authority given them, they caused the Council's petition against the Gas Company's Bill to be supported before the House of Lords Committee; and that before the examination of the Company's second witness was completed, and therefore before any part of the Corporation case had been considered, the Chairman made to Mr. Wedderburn, the Senior Counsel for the Corporation, a statement as follows:

> No doubt you are aware that in the Bill which has just been before us, a question has been raised with regard to the insertion of a purchase clause. We think the present time is not a good time to insert a purchase clause, and that the only thing I believe which would weigh really with us when re-considering the point is this—that very strong evidence must be given that there is a great desire for this undertaking to be purchased by the consumers, because they think they are being badly treated by the present Company. I think that gives a very fair indication of the mind of the Committee; and with reference to a letter which was written by the Corporation to the promoters on the point—that they would refrain from considering other details of the Bill unless they had got a purchase clause—the Committee are, as far as the case has gone at present, rather of opinion that it would even now be a good thing if the Corporation would re-consider the point. It might shorten the proceedings and be of advantage to the determination of the case.

Notwithstanding this, the Counsel for the Corporation and the Parliamentary Agents were strongly of opinion that it would be unwise for the Corporation to withdraw, and that it was necessary for the facts and grounds urged by them to be placed before the Committee. This course was followed. In the result, the Committee, without calling on the Counsel for the Company to reply, found the preamble of the Bill proved, and stated that they would go on with the clauses. Counsel for the Corporation expressed their emphatic view that if the Corporation discussed clauses before the Committee their position before the Commons, should they decide to carry the opposition there, would be weakened; and the Chairman was accordingly informed by Mr. Wedderburn that the Corporation did not propose to take any part in the discussion of clauses.

The Committee add that they have bestowed most careful consideration on the subject, and as they are advised by Counsel that the opposition should be carried to the House of Commons, and that it is desirable to ascertain the views of the ratepayers, they recommend that a public meeting be summoned within the next fortnight, and a vote taken on the question of purchase. They further recommend that in the meantime the Council present a petition to the House, and again ask for a purchase clause.

After some discussion of the proposal,

Mr. CHAPMAN said the town had spent a lot of money, and had nothing to show for it; but owing to the Council's opposition, the Company had themselves reduced the standard price of gas to 3s. 6d., and in spite of the unfair treatment the Corporation received, the House of Lords' Committee reduced the standard price to 3s. 3d. The existing gas-works were old-fashioned; and therefore the cost of production was high. But they were to be re-modelled, and the cost of production would then be reduced. What would be the result in ten or fifteen years' time if the production of gas remained in the hands of the Company, with gas produced at 2s. 6d. per 1000 cubic feet?

Mr. WALLACE said £1000 a year more would in that case be added to the dividends of the shareholders; and what on earth would they have done for it? It all came out of the pocket of consumers. If Parliament would grant the Corporation the right to purchase the undertaking at a fair and equitable price, it would be absolutely sure, certain, and safe as a commercial proposition. It was admitted by the Counsel and witnesses for the Company that the price of gas in the past had been higher than it ought to have been; and that there was no excuse for the Company not having come to Parliament years ago, while their accounts had not correctly disclosed the financial position of the Company.

Mr. TIMOTHY SMITH said he represented the working classes of Colchester, and he could say they felt that the necessities of life should belong to the people, and gas was one of the necessities. ["Hear, hear," and a laugh.] He thought that, on the principle of equal sacrifice, the Company ought to have approached the ratepayers and have said: "We present to the people of Colchester the gas-works as a going concern." [Laughter.] Ah! gentlemen might laugh. [More laughter.] The speaker went on to prophesy that if the working classes of Colchester did not get the gas-works, there would be a revolution in the borough.

Mr. R. B. BEARD intimated that he should vote against the proposal, for reasons which he could not express publicly. There were other clauses that the Corporation might fight against; but he thought these could be amicably settled.

Mr. CHAPMAN said that, by the desire of several ratepayers in the town, he asked if information could not be given as to the amount of money that had already been spent in this matter.

Mr. WALLACE said it had cost a lot more than they expected.

Mr. CHAPMAN: I can quite understand that.

Mr. WALLACE said they were led to suppose that it would cost £400; but it would cost between £700 and £800 (so far as he could see) in regard to the proceedings in the House of Lords; and opposition in the House of Commons was estimated to cost from £250 to £300.

The report of the Special Committee was agreed to by a large majority.

GERMAN CONTINENTAL GAS COMPANY.

Report and Accounts for the Year 1915.

The following is a summary of the contents of the report for last year of this Company, who have gas and electricity works in many parts of Germany, and also the gas-works at Warsaw.

The year to which the report refers is the first which has been throughout affected by the war; but it is stated that, notwithstanding numerous difficulties and disadvantages consequent thereon, it has been possible to continue work as hitherto and to fulfil all requirements. The total output of gas in the year was 100,684,332 cubic metres [about 3,551,090,000 cubic feet], which is 2·6 per cent. more than the output in 1914, which, owing to the outbreak of war, showed a decrease of 0·82 per cent. on 1913. The gross profit of the Company was 4,585,373 marks [about £224,773], which is an increase of 312,160 marks on that for 1914, which was 415,296 marks lower than in 1913. After placing contributions to the reserve funds on the usual scale, it is proposed to pay a dividend at the rate of 9 per cent., against 8 per cent. in 1914. The sum to be distributed as dividend for 1915 amounts to 2,538,000 marks.

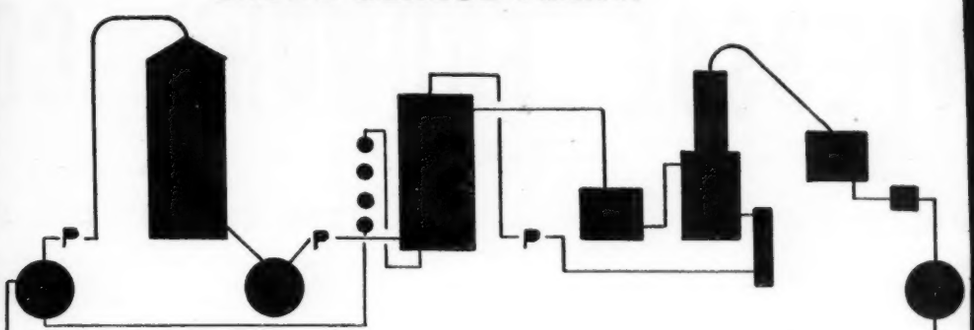
The report states that gas supply, which is the principal business of the Company, has not yielded good profits, owing primarily to the considerable rise in the cost of coal, and in a minor degree to the increase of wages, cost of materials, and voluntary allowances. It has not been possible to balance the greater expenses by increased returns from the sale of gas and bye-products, because the prices chargeable are in very many instances fixed or outside the Company's control. As these unfavourable conditions are unlikely to disappear in the immediate future, it would seem necessary to arrange for an alteration in the prices charged for gas in order to counteract them. Many corporation gas undertakings have raised their prices quite considerably, but the privately-owned concerns are precluded by agreements, &c., from taking this step. It has been due solely to the fact that the Company had in course of time become interested in electricity supply and other branches of trade that it has been able to achieve all round such satisfactory results during the past year. Its electrical undertakings have developed in a very gratifying manner, their working being independent of the price of coal, because the greater part of the energy they require is derived from central stations in the various brown coal or lignite districts under long-term contracts.

The Company have refrained during the year from acquiring new undertakings, from extensions at the present works, and from all renewals which were not imperatively needed. They participated to the extent of two million marks [nearly £100,000] in the three German war loans. Provision has been made, as in the previous year, for officials and men who have been called to the colours or detained by the Allies as civilian prisoners—the provision involving, it is stated, a very considerable sum. At the end of the year, there were 721 of the Company's German officials and workmen serving with the colours. The prospects for the current year are obviously uncertain owing to the political situation; but so far as the year has already gone, there has been no change in the Company's business position.

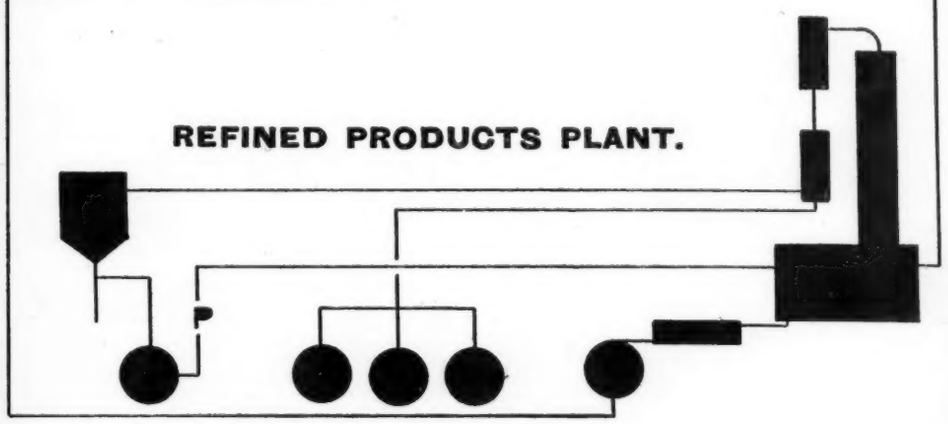
The Company's chief works are situated at the following places—viz., Dessau (gas and electricity works, chief offices, and central workshop), Warsaw (gas-works and chemical-works), Potsdam (gas-works), Frankfort-on-Oder (gas-works), Duisburg-Ruhrort (gas-works), Nordhausen (gas-works), Gotha (gas-works), Luckenwalde (gas-works), Hagen-Eckesey (gas and electricity works), Bismarckhütte (Upper Silesian central gas-works), Barr in Alsace (gas-works), Haguenau in Alsace (gas-works), Sörnewitz (gas and electricity works), Herbesthal (gas-works), Nienburg (gas-works), and Sandersleben in Anhalt (gas-works). The Company also have an interest in other undertakings, chiefly electricity supply works, but including also the Dessau Vertical Retort Company, of Berlin, and the Odessa Gas Company.

At the last meeting of the Board of the Kingston-on-Thames Gas Company, Mr. G. Clifton Sherrard, solicitor, of Kingston, was appointed a Director, in place of the late Mr. Samuel Gray, J.P.

CRUDE BENZOL PLANT.



REFINED PRODUCTS PLANT.



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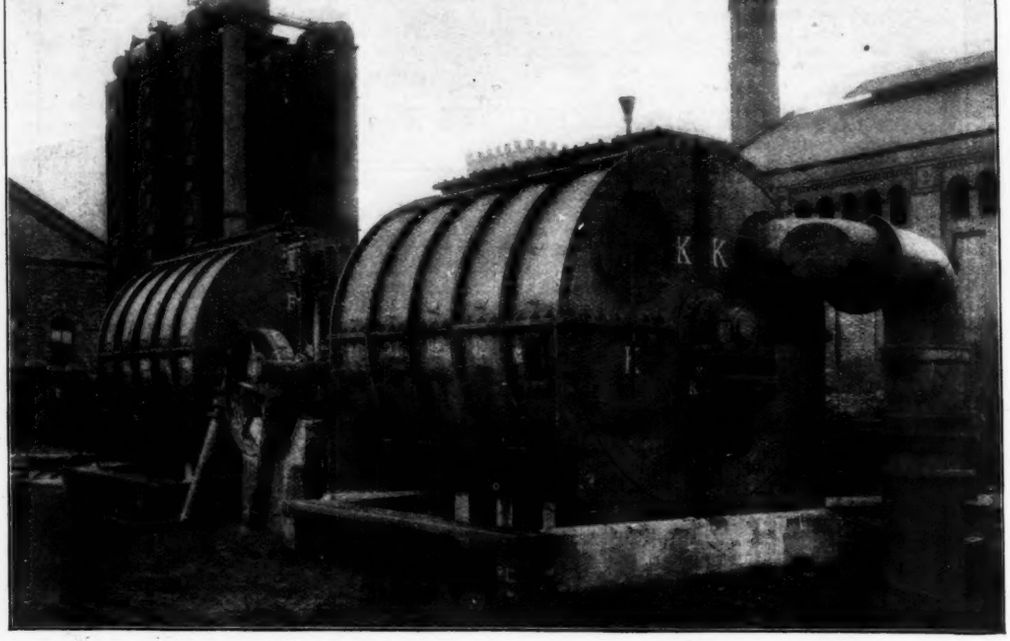

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WALKER & WALLSEND GAS CO.,
TYNEMOUTH GAS CO.,
STOURBRIDGE GAS CO.,
DURHAM GAS CO.,
YOKOHAMA (JAPAN),
KOBE (JAPAN), &c., &c.

BIRMINGHAM AND THE GAS DEPARTMENT.

The Past Year's Working Results.

At last Tuesday's meeting of the Birmingham City Council—the LORD MAYOR (Alderman Neville Chamberlain) presiding—one of the most interesting items of business submitted was the report for the past year of the Gas Committee—see *ante*, p. 519.

Sir HALLEWELL ROGERS (the Chairman of the Gas Committee), in moving the adoption of the report, said: The past year has been a very strenuous one for all connected with the Birmingham Gas Department; and I should like at once to express, on behalf of the Committee, our keen appreciation of the loyalty and devotion of the staff throughout a most anxious and trying period.

To meet such a huge demand for gas as is indicated, even in normal times, would have occasioned considerable anxiety; but when this has had to be met with a serious shortage of labour at the gas-works, difficulty in obtaining coal, and in the disposal of many of the residual products—coupled with the loss of over 160 of the permanent official staff who have joined H.M. Forces, and the building up and training of a new temporary staff—the Council will realize the extent of the labours of the Committee's employees in so successfully keeping the department up to its usual efficiency. We have had to call upon the remaining workmen for a considerable amount of overtime and speeding-up, without which we could not have carried on.

The one regret your Committee have is that it became necessary during the winter to cease the issue of domestic heating apparatus, and to appeal to consumers to economize in the use of gas. Without the assistance this gave, however, it is very probable that the supplies of gas to munition factories would not have been maintained. As it was, the output of gas in the week ending Dec. 22 reached the record figure of 296 million cubic feet. We were, in fact, hard-pressed during the whole of the winter, but have now turned the corner; and in view of the increased manufacturing capacity we shall obtain from the extensions at Nechells, your Committee have removed the restrictions as to the supply of apparatus for domestic consumption. But should the difficulties again become apparent next winter, they rely upon consumers exercising economy in the use of this apparatus.

The total consumption during the year has, for the first time, exceeded 10,000 million cubic feet—the increase compared with last year being 908¾ million cubic feet, a quantity which, to adopt an illustration, would in itself supply the total yearly requirements of any one of the following towns: Blackburn, Bolton, Burnley, Huddersfield, Northampton, Stockport, Southampton, or Wolverhampton. In consequence of the large amount of munitions manufactured in the city, Birmingham has been more fortunately situated than many gas undertakings in the kingdom whose consumption of gas, owing to the restricted lighting orders, has shown a substantial decrease compared with pre-war years. Here, whatever reduction in consumption has been caused by the restricted lighting, has been more than counterbalanced by the huge demand for manufacturing and cooking purposes. It is interesting to record that, so far, the Summer Time Act has caused no apparent diminution in the demand for gas.

Apart from the large number of employees who have been released for service with the Colours, the department are actively assisting the Government in the prosecution of the war in the following ways:—

(1) From every cubic foot of coal gas produced at our works we are extracting, under agreement with the Government, raw material necessary for high explosives; the total quantity so produced having reached a very large figure. Captain Hilton and several of the staff of the department have been taken over by the Government to assist the Ministry of Munitions to organize the gas undertakings in the country for this purpose.

(2) Our chemical staff have undertaken much valuable research work for the Government.

(3) The industrial heating laboratory, established by your Committee some years ago, has been hard at work in research and experimental work for manufacturers in the city during the present war in designing special gas-furnaces for the production of munitions; and there is little doubt that the work of this section has resulted in a largely increased output of such munitions.

High-pressure gas is now being used in connection with the melting of brass and gun-metal; and as regards the enormous quantity of high-explosive shells and other projectiles now being produced in Birmingham, there is hardly a component part in the making of which town gas does not enter as an essential fuel. Gas is also being used for the heat treatment of "high-speed" and other special steels largely used for the manufacture of tools and gauges.

I am also pleased to state that the research work carried out by the department in conjunction with the manufacturers has resulted in the satisfactory production of goods which were not hitherto manufactured in the city—a trade which it is hoped will be retained after the war.

Apart from the good results which are likely to accrue to the department in the future from this extended use of gas, the Council will, I am sure, be pleased to learn that the policy of the Committee in setting up this special industrial heating section has been so fully justified.

Dealing now with the accounts, I venture to think that, in view of the abnormal conditions, the Council will consider the results satisfactory; for although the cash payment to the relief of the rates is slightly less, last year £12,000 was taken from the reserve fund to cover the allowances to employees with the Forces and other war charges. But this year the Gas Committee have paid these charges out of revenue, which they consider a more satisfactory way of dealing with the item. Excluding the war charges from both years' accounts, we get the following figures:

	1915.		1916.
Gross profit	£171,348	..	£195,138
Net profit	39,061	..	56,624

The annuities are, for the first time, under £1,000,000, and the capital outstanding has been reduced to £1,817,699—equal to 3s. 2¼d. per 1000 cubic feet of gas made, which is lower than most of the gas undertakings in the country. The capital expenditure of £22,353 is principally accounted for by the provision of new purifying plant at Swan Village, and the foundations for the extensions authorized by the Council at Nechells.

Turning to the revenue account, there is a large increase in the cost of coal and oil—due, of course, partly to the larger quantity carbonized, but principally to the much higher prices charged. In passing, the Committee express their appreciation of the way in which the coal contractors, with very few exceptions, have kept the department supplied during the last twelve months, notwithstanding the many difficulties with which they have had to contend. The market for both materials is still a most difficult one; and unless some action is taken by the Government to increase the supplies of coal for home consumption, and to assist the suppliers of gas oil in regard to freight, the position of all gas undertakings in the next twelve months is likely to be even more anxious than during the past year. The increased cost of wages is principally due to the advances granted by the Council. There is an increasing burden on the department for rates and taxes. The allowances to employees with the Colours show an increase of £16,000. The total number of the Gas Department employees who have joined H.M. Forces is now 856; and the Committee regret that notification has been received of the death of 23 of this number. One of the staff—Mr. W. C. Treen, a Sergeant in the 3rd South Midland R F.A.—has been awarded the D.C.M.

On the credit side of the accounts, for the first time in the history of the department the income from the sale of gas is over one million sterling. I have already alluded to the huge figures of consumption of gas; but the Council will be interested to learn that the quantity of gas used in manufacturing processes (apart from motive power), shows an increase compared with last year of over 65 per cent., and in the last six years has increased by 285 per cent. The income from residual products also shows a satisfactory increase—due partly, of course, to the large quantity of coal carbonized, but also to the higher market prices obtained for many of the residuals.

I do not think there is any need for comment on the remaining accounts; but the statistics appended to the report are very interesting, as denoting the tremendous growth of the department. We carbonized 82,000 tons more coal last year than the previous one, and used 226,000 gallons more gas oil; and the consumption of gas has more than doubled itself in the last twenty years.

With regard to the outlook for the current year, the Committee hope to be able to maintain the present prices for gas; but with the difficulties experienced in obtaining coal and oil, and the greatly increased price of freightage on the latter, it may be necessary to come to the Council at a later date for revision of the prices.

Apart from the question of coal and oil, like all large industrial concerns, we are also struggling with a most serious shortage of labour. To meet the anticipated increased demand next winter, we are extending our coal-gas plant at Nechells works; but to adequately man this plant will be a most difficult task. The Council will be interested to learn that we are at the present time employing female labour on several of the gas-works for screening and loading coke; and it may be possible to utilize women in other small sections of our work. But, unfortunately, the majority of the labour at the gas-works—particularly retort-house work—is of such a nature as to preclude the employment of women. We are, however, facing the problem hopefully; and, with the continuance of the loyal assistance of the employees, both staff and workmen, and the co-operation of the consumers, the Committee trust to be able to meet all the demands upon the department during the ensuing year.

Sir WILLIAM BOWATER seconded the motion.

Some slight criticism was offered of the action of the Committee in selling a piece of their freehold land without first getting the consent of the Council, and at the decision to fill up the available space in No. 2 retort-house at Nechells with plant of the horizontal type.

The CHAIRMAN, replying, said the sale of land referred to was a very small matter indeed. He defended the installation of horizontal as against vertical plant, by saying the latter would have involved the raising of the roof and increasing the cost.

The report was then approved.

NOTTINGHAM GAS PROFITS.

Very general satisfaction was manifested at the meeting of the Nottingham City Council on Monday week regarding the gratifying nature of the annual report of the Gas Committee [*ante*, p. 519].

Alderman A. BALL, in moving the adoption of the report, said that no doubt it would be satisfactory to the Council, inasmuch as it showed a very much better year's trading than the Committee anticipated. The result achieved was largely due to the advantageous purchase of coal which was made a few years ago, and to the energy and determination which their Engineer (Mr. John Wilkinson) had thrown into the work. Mr. Wilkinson had a very trying year, and personally he (the Chairman), as he was sure also every member of the Committee, felt very much indebted both to him and his staff for the way in which they had conducted the business during the past twelve months. He also desired to congratulate their old Accountant (Mr. William Garton) upon his excellent work. The years kept rolling on, but seemed to make no difference to Mr. Garton. The gas undertaking of the city was, it was gratifying to record, to-day in a very satisfactory condition. If the resolution, embodying the Committee's recommendations, was carried, it would mean that their ordinary reserve fund would stand at £206,480. But the works had not been starved. During last year something like £70,000 had been spent in ordinary renewals of mains and meters. In addition, they had laid out £13,000 upon special renewals; and if the report was passed, they would have in hand, on the special reserve fund, £112,735 for renewal purposes. A good deal of the money in this fund was ear-marked. When the reconstructions now in progress were finished at Basford, the plant there would constitute one of the most up-to-date works in the country. The future, however, of gas concerns appeared at present to be very black. Colliery owners wanted so much for their coal that committees in charge

of gas undertakings hardly knew how to find the money to pay for it. For the present, however, they had managed to meet the demand in Nottingham very satisfactorily. Their stocks of coal were not what they should be. At the present moment, they had only about three weeks supply in hand to meet their maximum requirements; so that unless some great improvement took place regarding matters before the winter came, they would be faced by a very difficult problem. The increase of 12½ per cent. which had been made locally upon the price of gas during the past twelve months had resulted in extra revenue to the extent of £17,388. Some members of the Council might think the increase was unnecessary. He felt, however, it was a very wise step to take; the increased rate being very much below that adopted by many other large gas undertakings in the country. He hoped that the Committee would be able to maintain the supply of gas at its present price; but if the cost of coal continued to increase in the future at anything like the rate it had done in the past twelve months, it was certain the Committee would be faced with the unfortunate problem of a further increase in the price charged. He hoped that any such increase might be averted. At any rate, the present report of the Committee would, he thought, be regarded as satisfactory by every member of the Council.

Mr. H. G. FORD, the Vice-Chairman, seconded the resolution, and it was adopted.

In connection with this year's review of the position of the Nottingham gas undertaking, some interesting figures have been made available, indicating developments during the last decade. The gas sold last year totalled 2,151,028 cubic feet, compared with 1,927,945 cubic feet in 1907; the average price charged in the latter year being 2s. 6·05d., compared with 2s. 7·84d. more recently. In 1907, the gross profit amounted to £105,752; there being a steady rise in the three subsequent years. The profit in 1908 increased to £106,250; in 1909, to £106,940; and in 1910, to £110,297. There was a fall in 1911 to £103,713; but the total recovered to £106,595 in 1912. In the three subsequent annual periods, there was a notable advance—the figures for 1913 being £129,305; for 1914, £131,917; for 1915, £130,083; while last year the gross profit was £125,887, to which must be added a balance brought forward of £10,709. Interest and sinking fund charges, &c., fell from £53,449 to £48,530 last year. There has been a constantly increasing application of financial resources to special funds, rendering the possibility of important new works being carried out without trenching upon reserves. In regard to residual products, receipts last year showed a substantial increase under two headings. Coke and breeze realized £56,559, against £43,638 in 1915, and sulphate of ammonia £27,271, compared with £20,217. Tar and its products, however, indicated a decline; £17,191 being obtained last year, compared with £21,588 in the preceding twelve months.

ST. HELENS GAS-WORKS' PROFITS.

A Net Yield of Nearly £4000.

At last Wednesday's meeting of the St. Helens County Borough Council it was stated that at a meeting of the Gas Committee a letter was submitted from the Board of Trade, asking the Corporation to notify to their consumers of gas and electricity that the Government desire to see the consumption of coal for lighting purposes reduced by 10 per cent., and requesting them to do all in their power by notices and inspection to see that the recommendation is carried out. It was resolved that the gas inspectors be instructed to notify all consumers of gas accordingly. A similar letter was submitted at the meeting of the Electricity Committee, who resolved that the charge for energy and for lighting purposes be increased by 20 per cent., instead of 10 per cent. The Treasurer submitted a balance-sheet for the year ended March 31, 1916, showing a net profit, subject to audit, of £3903. It was resolved that the profits be kept in reserve to meet expenditure on works extensions.

Alderman CROOKS (the Chairman of the Gas and Lighting Committee), in moving the adoption of the minutes, said the Council would observe that the results of the financial year's working showed a net profit of £3903; and the Committee recommended that the price of gas continue to be charged at the same rate as last year. The results had been obtained under most difficult circumstances, imposed by war conditions, and gave the Committee confidence in hoping that they might be able to proceed without any further increases in the charges for gas. The high price of coal and the uncertainty of obtaining supplies at all were the great difficulties which the Committee had to face at the present time. During the past year, the Lighting Committee, acting under the Lighting Restriction Order, had been required to cut-down public lighting to the minimum, and had by this means saved about £2000 expenditure in the department. By means of the decreased use of gas for public lighting, earlier closing hours, &c., the output of gas had been reduced during the year by just over 9 per cent. The use of gas for all domestic and manufacturing purposes had been well maintained during the year. This reduced output saved the purchase of some 4500 tons of coal, and further economies, brought about by the extended use of improved methods at the works, saved the use of upwards of 1000 tons of coal—making 5500 tons in all. But, notwithstanding this economy, the regular supplies of all classes of coal were so difficult to obtain that, had the Committee not authorized the Engineer during the previous year to purchase and store all the coal he possibly could, the town would have been in danger of running short of gas. As it was, they were able to provide nearly 6000 tons out of their stocks, and had only 1000 tons left in the spring. The Engineer had instructions to replenish the stock, but it was impossible at present to do so. The total make of gas for the year was 514,800,400 cubic feet, and the production of gas per ton of coal used was greater, during the year, than ever before. There had been no expenditure on capital account during the year. That which had been absolutely necessary had been done out of revenue account, as the Committee desire to put off any further expenditure until after the war, if possible. The outstanding amount on capital account on the whole gas estate was now only £99,816, and the gross profit on last year's working averaged 13½ per cent., made up as follows: Repayment of loans, &c., £5554; interest, £4055; surplus profits, £3903—total, £13,512. The Committee recommended the Council to devote the surplus profit to the reserve fund. The total number of consumers at the end of March was 20,150. The amount provided during the year on war wages account was £951, and food bonus account £243; the total being £1194.

The minutes were adopted.

BURY (LANCS.) GAS SUPPLY.

The Results of the Past Year's Working.

At the last meeting of the Bury (Lancs.) Town Council, it was reported that the Gas Committee had resolved that the price of gas for the year ending March 31, 1917, be as follows: A uniform charge of 2s. 10d. per 1000 cubic feet to consumers in the borough, and 3s. 7d. to consumers outside—subject to discounts for prompt payments. For gas used for lighting and heating 1d. per 1000 cubic feet. For gas used for motive power and manufacturing purposes, 100,000 cubic feet a quarter, 3d.; exceeding 100,000 but not exceeding 500,000 cubic feet, 5d.; exceeding 500,000 but not exceeding 1,000,000 cubic feet, 7d.; exceeding 1,000,000 but not exceeding 2,000,000 cubic feet, 9d.; exceeding 2,000,000 cubic feet, 11d. It was also agreed that consumers using prepayment meters be allowed 27 cubic feet of gas for 1d. The Town Clerk reported the receipt of a letter from the Board of Trade, enclosing a copy of a notice recently issued by them calling attention to the special need for the greatest economy in the use of fuel at the present time, and asking the Committee to do all in their power to see that such recommendation is carried out. The Committee, after hearing the views of the Manager (Mr. Henry Simmonds) on the subject, decided to leave the matter in his hands to deal with. The Town Clerk read a letter from the Municipal Employees' Association, submitting the following resolution with reference to the increase of wages recently granted by the Committee to certain of the workmen employed by the department: "We, employees of the Bury Council, in mass meeting assembled, declare our dissatisfaction with the decisions arrived at by the various Committees, and herewith request the General Purposes Committee to receive a representative deputation at an early date, for the purpose of further consideration being given to the application. Further, we strongly protest against the action of certain Committees in paying wages increases without our collective consent having been given to the arrangement through the District Secretary. And, finally, we request the Council, in future, to await our consent prior to putting wage increases into operation." It was resolved that the letter lie on the table.

Mr. S. KAY, in moving the confirmation of the minutes of the Committee, said: The profit for the year is £406, which though not a large one, is on the right side, and must be considered satisfactory. The price of gas was raised 3d. per 1000 cubic feet to meet the increased cost of all materials required for the manufacture of gas, which have been steadily rising throughout the year, until now in many cases they are more than double what we had to pay previous to the war. The Gas Committee could have followed the example of many other gas undertakings, and advanced the price of gas by 6d. per 1000 feet, and made larger profits; but they considered it was a wiser policy to fix the price so that there would be no loss on the year's working. The consumption of gas during last year was lower; but this cannot be wondered at, considering how rigidly the lighting restrictions have been enforced—the public lamps consuming 14 million cubic feet less than in the previous year. Not only has the public lighting been decreased to a minimum, but shops and private houses have also had to effect a reduction. Then again, many families are economizing in the use of gas; and I am afraid that this would be felt more in the coming year, now that so many of the married men were being called to the Colours. The Daylight Saving Bill will also affect us to a fairly large extent, especially when people become more accustomed to it, and retire earlier at night. We are hoping to persuade people that they would be effecting economy, and helping their country at the same time, if they would use the gas which they saved in lighting in connection with cooking and heating appliances. The Committee propose to adopt the same policy this year as last, by fixing the price of gas to meet the extra cost of materials, &c., which were estimated to be: £5400 more for coal, £1910 more for rates and taxes, £585 more for interest on loans, &c., £700 more for wages, and £500 more for materials—making a total of £9095. Against this, it is estimated that £2500 more will be received from residuals, leaving £6595 to be provided for by increasing the price of gas, which the Committee have decided to do by raising the price 4d. per 1000 cubic feet to ordinary consumers, and reducing the amount given through prepayment meters from 31 to 27 cubic feet for 1d. This will give an increased revenue of £6627, and an estimated profit on the year of £32. The Gas Department had, in common with many other business concerns, been handicapped by the difficulty in obtaining supplies of coal and other materials. The shortage of suitable labour to replace those men who have joined the Army has also caused considerable anxiety. Though the manufacture of gas is considered a certified trade, the Committee are very proud to know that they have on their rolls the names of 35 employees who are serving, or have served, their King and country in the present war.

At a subsequent stage of the proceedings,

Mr. KAY said the Committee had realized a considerable profit from residuals; and but for this their loss would have been a tremendous one. Coke had realized £11,888; tar, £2835; sulphate of ammonia, £5611. If they had not made this profit, the department should have come out with serious losses.

Alderman GREENHALGH suggested that the Committee should take into consideration the desirability of producing disinfectants for use by the Health Committee, who now paid a considerable amount per annum on this account. He did not see any reason why the Gas Committee should not be able to produce a disinfectant to be put down the

sewers, and one he thought which would effect a considerable saving to the Corporation.

Mr. KAY said that in Mr. Simmonds they had a splendid official; and if anything could be done in the way suggested it would be.

Mr. BRADLEY: He has been engaged for twelve months on explosives; so that I do not think we should proceed at the present moment with Alderman Greenhalgh's suggestion.

The minutes were confirmed.

WEST BROMWICH GAS UNDERTAKING.

Engineer's Salary.

At a meeting of the West Bromwich Town Council last Wednesday afternoon, the Gas Committee recommended that the salary of the Gas Engineer (Mr. W. H. Johns) be increased from £500 to £550 per annum, as from June 1. Letters were received from the West Bromwich Tradesmen's Association and the West Bromwich Branch of the I.L.P. opposing the increase.

Alderman J. BROCKHOUSE, in submitting the recommendation, said the Committee were unanimous in making it. The work of the department during the last twelve months had been very trying. He was proud that they had at the head of the concern a man both young and strong, and full of energy and determination to carry on the works with the utmost efficiency.

Mr. BELL agreed that the Engineer was an exceedingly able official, who had rendered valuable services to the undertaking. He urged, however, that he had been in the position for barely two years, and his commencing salary was equal to that at which his predecessor left off; and if the Council granted the increase, they would establish a precedent, and a higher rate of salary than they in West Bromwich had been in the habit of paying their gas engineers. He considered the time inopportune to raise the salaries of men who were already well paid.

Mr. VAUGHAN supported the recommendation, and said he could not understand the attitude of the Labour party, in view of the increase, amounting to thousands of pounds, and equal to not less than a 3d. rate, that had been granted to the Corporation employees. Their protest against the proposed advance to Mr. Johns was grossly unfair. The undertaking was a commercial concern; and if there was not a downright good man in control, there was a very serious danger. If they wanted reliable and efficient service, they must be prepared to pay for it; and he hoped there would be no support for the views expressed by Mr. Bell. During the war the difficulties of running the gas-works had been enormous—especially in obtaining supplies of coal, the control of labour, the adjustment of wages, and the keeping in repair of the plant.

Mr. BATES said the points raised by Mr. Bell were thoroughly considered in Committee; and he felt the increase was justified.

Mr. BACHE thought the Engineer had well earned the increase; and he mentioned that the turnover of the undertaking was greater than it had ever been in the past.

Alderman BROCKHOUSE said Mr. Johns had got more out of the works than anyone before; and they would make the biggest mistake possible if they did not grant the increase.

The MAYOR also said he was thoroughly convinced this was the proper thing to do.

The Council then granted the increase; Mr. Bell alone voting against it.

The Working Results.

At the same meeting of the Council, Mr. Johns' report on the results obtained during the twelve months ended March 31 was approved.

The report showed that the quantity of coal carbonized during the year was 32,032 tons, as compared with 31,458 tons in the previous year; and the quantity of coal gas manufactured per ton of coal carbonized was 12,201 cubic feet, as against 12,026 feet. The make of gas per ton of coal carbonized during the year ended March, 1914, was 11,177 cubic feet. The increase in the cost of coal when the contracts were renewed in July last amounted to 40 per cent.; but owing to the existing contract for gas oil, it was possible to obtain supplies of this fuel at a very favourable figure. The market price of gas oil at the present moment, Mr. Johns adds, ranges from 100 to 150 per cent. above the contract price referred to; and even then supplies are practically unobtainable. The heavy stock of oil now held will be of great advantage, bearing in mind the likely shortage of coal and labour next winter. Even more will have to be paid for coal supplies when existing contracts expire in June; and this fact, together with increased wages and cost of materials, will affect the results for the ensuing year. The quantity of carburetted water gas made was 32,958,000 cubic feet, or 7·44 per cent. on the total gas made.

The total quantity of gas made during the year was 423,797,531 cubic feet, against 417,701,000 cubic feet in the previous year. The gas used on works amounted to 5,831,000 cubic feet, as compared with 5,888,000 feet. The total sales were 395,283,868 cubic feet, as against 396,948,284 feet. The output of gas for the first nine months of the year exceeded that for the corresponding period (which was a record year) by 9½ million cubic feet. During the last quarter of the year, this increase was neutralized by a corresponding decrease, brought about by the earlier closing of hotels and licensed premises, the lighting restrictions, and the discontinuance of public illumination.

The gross profit for the year amounted to £13,183, compared with £11,352. Interest and sinking fund charges amounted to £10,107, and £231 was paid off the cost of the 1913 Parliamentary Bill. The net profit was £2845, as compared with £1307 for the previous year.

Mr. Johns says he is pleased to report that the quantity of coke avail-

Main Munitions.

THE most important munitions in your Summer campaign are Cookers. Every care is exercised in the manufacture of "Main" Cookers so as to ensure their giving the highest possible efficiency. Their range covers all contingencies. There is originality in the treatment of detail consistent with effectiveness and with an eye to economy in replacement. Make them your allies in advancing your summer sales.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

able for sale was increased last year from 7·1 to 8·6 cwt. per ton of coal carbonized. This figure is still low compared with the results obtained by many undertakings; but the West Bromwich Corporation have been in the habit of breaking a large proportion of their output to produce special coke and breeze, and a considerable quantity of coke dust is thus formed. It has also been found that this dust is increased with the lighter class of coke produced in the vertical retorts. Considerable benefit has been derived from the vertical retort plant during the past winter. On this plant, a higher degree of efficiency is obtainable as regards the production of gas and quantity of coal carbonized per man employed; and under the prevailing conditions this economy of available labour has been most essential. It has also been found necessary to introduce some female labour into the works for coke picking and screening, and for oxide breaking.

The department continues to receive inquiries for gas-heated furnaces and stoves for annealing, hardening, and metal melting; and several installations have been fitted up during the year. At the present time many repeat orders are in hand; and in this way it is hoped to counterbalance the loss of output for lighting purposes. There has been a considerable falling off in the number of consumers' burners under maintenance, due to the lighting restrictions. During the early part of the year women were trained to undertake this work, in the place of men released for the war; but owing to the reduced lighting it has been found necessary to dispense with their services.

The unaccounted-for gas, brought about through leakage, condensation, and variations of temperature, amounted to 22,005,362 cubic feet, or 5·2 per cent. of the gas delivered, as against 14,864,716 feet, or 3·56 per cent. The increase, Mr. Johns says, may possibly be accounted for by the greater degree of condensation due to the higher yield of gas per ton of coal carbonized. This figure is rather better than the average figure for the most important towns in the country, and is far better than that found in many other undermined districts. During the year, several serious fractures of the mains occurred, causing considerable loss of gas; and although it is the practice to systematically inspect the condition of the mains in those parts of the district where subsidence of the ground occurs, and to test all the larger mains, it has been found impossible to keep pace with the work owing to the reduction in the number of fitters available.

WIGAN GAS UNDERTAKING.

When the Gas Committee's minutes came up for confirmation by the Wigan County Borough Council, at their meeting last week, attention was called to the financial statement for the year ended March 31.

Mr. FARR, in moving the adoption of the minutes, said the year under review consisted of seven months under the old Committee and five months under the present one. While it might be suggested that they had perhaps on the face of the statement nothing to boast about, on the other hand he thought it safe to say they had much to be thankful for. The concern had met with a considerable amount of success, and credit was due both to the management and the Committee. They had been faced with all kinds of difficulties. A supplementary financial statement showed that the actual net balance, being the profit for the year, was £1978 less than last year. This was easily explained. They had spent £1400 out of revenue on new meters which in the ordinary course would come out of capital, and also £500 for a new boiler. They had given £900 in war bonus and relief, and had handed over as a Corporation the handsome donation of £102 to the three Red Cross Hospitals, in the form of free gas. As to the future, Wigan never seemed to have the luck that came in the way of other towns. There were towns in Lancashire where munition works had been established which were consuming enormous volumes of gas; but no luck like this came Wigan way. On Feb. 1 they started their cookery campaign, the results of which were exceedingly satisfactory. From that date to June 5 they had over 950 slot-cookers ordered, and 367 had been fitted. In addition, their depôt had not been idle; and they had secured orders for 666 ordinary cookers. They had been fitting cookers at the rate of 36 per week; and he thought some tribute ought to be paid to the loyalty and industry of the men engaged on the work. It was one of the smartest pieces of work he had come across in the Council. It might be interesting to know that if they got 1000 cookers to use a reasonable average amount of gas, it could make a difference of 2½ per cent. on the total output. There were 13,000 consumers taking gas through slot-meters; and they had only 1000 for slot-cookers. They ought to have 4000 or 5000. They had difficulties to contend with in the Summer Time Act; and the Engineer (Mr. F. Betley) had prepared them for a shortage of coal. They would, however, do the best they could to keep the concern in as good a condition as it was at the present time.

Mr. M'CURDY, in seconding, said there had been many conjectures as to the effect the Daylight Saving Bill would have on the industry; and the Engineer had given him some figures. For the first week, the consumption was down by 200,000 cubic feet. Last week it was more; and they reckoned it would affect them to the extent of 5 per cent. of the total output. It was a substantial amount, but not as much as they expected.

Dr. REES said one of the greatest nuisances in Wigan was smoke; and one way of stopping it, in addition to the activity of the Health Committee, would be for the people throughout the town to use gas instead of coal-fires.

The minutes were approved.

At last week's meeting of the Shoreham Urban District Council it was reported that the Brighton, Hove, and Preston Gas Company had given notice of the forthcoming increase in the price of gas of 3d. per 1000 cubic feet.

"No idea you'd such a beautiful place here!"

The above exclamation is typical of numerous admiring expressions used by visitors last week to the

Davis Exhibition Salons, 60, Oxford St., W.,

and in its own colloquial way is richly significant of the surprise commonly evoked by the decorative beauty and Gas-completeness of the Davis Exhibition as a whole.

THE DAVIS GAS STOVE CO. LTD

WORKINGTON GAS-WORKS RESULTS.

By way of preface to his annual statement to the Workington Gas Committee for the year ended March 31, Mr. Horace Chamberlain (the Engineer and Manager) says: "The new carbonizing plant was put into operation on Oct. 5, 1915, and since that date has supplied the whole of the gas made without the slightest hitch, leakage, or stoppage. The workmen are all delighted with the improved conditions; and I am pleased to say that they have well adapted themselves to the new methods. This is very gratifying, when taking into consideration that the new method of carbonization completely revolutionizes gas-works practice. The Distribution Department has been a great success; the sale of gas-heated apparatus during the year having far exceeded the combined output of any previous six years. This year has been a great strain on everyone concerned; the work having been carried out under the worst conditions in the memory of any living man. I do not think any gas-works in the world has carried out the work we have done under such circumstances as we are experiencing at the present time." The gross profit this year is £2783, against £2532 in the previous year; being an increase of £251. The net profit, after paying interest, sinking fund and loan repayments, bank interest on temporary loans, and proportion of war wages, is £300, which has been transferred to the renewals fund. The net profit in the preceding year was £746. The decrease in the net profit is entirely owing to higher capital charges in respect of new loans and the proportion of war wages payable by the Gas Department.

Alderman HALL, in moving the adoption of the report, said they had sold over 8½ million cubic feet more gas during the past year than in the previous year, which constituted a record for the department. They had increased their yield of gas per ton of coal from 12,306 to 12,910 cubic feet—equalling a saving of 485 tons of coal at 19s. 1½d. per ton, or £463. This was considerably more than the salary they paid to their Engineer. One important reason for the increase in the gas sold was the great success of their new venture—the Gas Distribution Department. The total increase in the number of consumers was 241; and the number of gas-cookers in use had been increased by 291. They had had a transition period last year, passing from the old to the new; and this was accomplished without anybody in the town being the wiser. He thought they ought to feel proud that they had such an Engineer as Mr. Chamberlain, who could effect this without the town being in the slightest degree inconvenienced. In the gas-works revenue account, they had again a record. They had received from gas-rentals £13,241. If they allowed for the increase in the cost of coal and the various other matters which had affected the balance, they had actually had a better year by £1432 than they had the year previously. The plant was now in thoroughly good working order; and the results of this year's working would become the standard for the new vertical installation. He might mention, however, that in 1901, when coal was 17s. per ton, they had a deficit on the year's working of £2613; the reserve fund was exhausted, there was a bank overdraft of £802, and the gas for the first six months was 2s. 6d. and the second six months 2s. 11d. per 1000 feet, as against the price of 2s. 3d. in the past year. So they would see how far they had gone since that time in the process of manufacture. They had paid last year £1875 more for coal than they did the year before. The department had great difficulties in front of them; and unless they could improve upon their good showing this year, he was afraid they would not balance their next accounts.

LABOUR SHORTAGE AT VENTNOR.

Closing of the Gas-Works Hinted at.

At the last meeting of the Ventnor District Council—Mr. F. Baker, J.P., presiding—the following letters from the Secretary and the Chairman of the Ventnor Gas and Water Company were read:

I am requested by my Board to write and ask you to lay before your Chairman and members of the Urban District Council the following particulars.

At the commencement of the war all our men, with the exception of two and the aged ones, were taken. Afterwards we kept picking up one or two and trained them to the work. Still they were taken from us. We then secured two or three absolutely unfit for military active service; but they were still taken from us without any notice, and sent to guard prison or internment camps. We have struggled on against enormous difficulties, doing our best to maintain supplies of gas and water. Gas at the present time is more a public necessity than ever; for, owing to the high price of coal, it is used now in Ventnor to a much larger extent for cooking purposes, &c. Our men have all been taken, notwithstanding a strong protest by the Company to the military and other authorities that it is very essential in the public interest they should remain; and I may say the majority have been taken without a day's warning to the Company. We have now reached our limit, having but one stoker left.

From this it will be quite evident to the members of your Council that it is impossible to keep up a regular and constant supply. I am afraid we shall have to curtail to a great extent, if not actually close-down altogether. We are very reluctant to do it; but it will be impossible to do otherwise. Our usual number of stokers is four; now we have but one.

We are writing to the Ministry of Munitions of War respecting the position. I can only hope they will render us some assistance to enable us to keep supplies going. Perhaps in the public interest your Council might be able to render us and the inhabitants of Ventnor some assistance by writing or applying to the War Authorities.

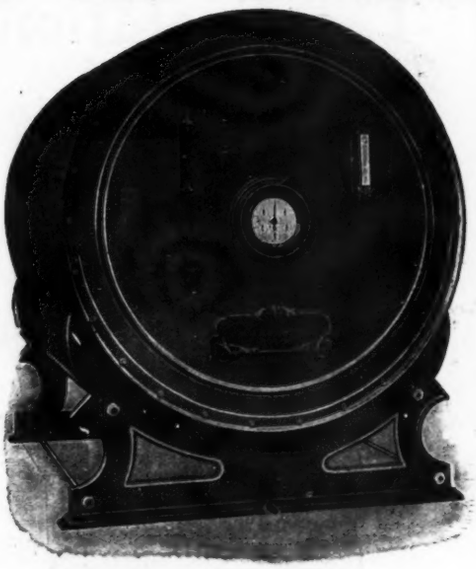
(Signed) J. S. INESON.

Owing to the continued depletion of our staff by recruiting and

BRADDOCK'S IMPROVED GAS METERS

SECOND TO NONE.

Made in all Sizes.



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J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM,**

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through the difficulty of retaining the services of men not so taken, we are now reduced to one stoker; and I feel it right therefore to inform you beforehand that, failing a fresh supply of labour being obtained during the next few days, the Company will be unable any longer to maintain the supply of gas, and will therefore, very shortly, be compelled to close the works and discontinue the supply.

Every possible expedient has been exhausted in the endeavour to maintain our staff. The Secretary of the Company has been instructed to write you more fully to the above effect.

(Signed) VICTOR G. MIDDLETON,
Chairman.

The CLERK, in answer to a question, said the letters were dated May 13.

Mr. CATER: They have kept going a fortnight then.

The CHAIRMAN said he did not think a single stoker had applied for exemption before the Tribunal; and the Company themselves did not appeal. The Council had nothing to do with the men leaving the Company.

Mr. BURROUGHS thought the stokers were men over military age.

Mr. VINCENT said the Company evidently wanted the Council to help them in the matter.

The CHAIRMAN said Mr. Middleton's letter made it appear that it entirely depended on the Council whether they closed-down the works or not.

Mr. VINCENT pointed out that the Company were subject to an Act of Parliament, and had certain things to do.

The CHAIRMAN then suggested that the letter should be passed on to the military authorities.

Mr. CATER thereupon moved that the letter be sent to the Commanding Officer of the Island Forces at Parkhurst. If they could do anything at all to assist the Company they should do it—not for the sake of the Company, but for the town. It would be very inconvenient if they were without gas, which, as the letter said, was being used in increasing quantities for cooking. If the assistance to be obtained was only temporary, it would be a help.

Mr. VINCENT seconded; and the proposition was carried.

Effect of Daylight Saving at Middlesbrough.—The Mayor of Middlesbrough (Mr. J. Calvert), as Chairman of the Gas Committee, announced to the Council last week that the consumption of gas for lighting purposes fell 14·1 per cent. in the first week of the operation of the Summer Time Act; but the public had recognized the economy of using gas cookers and heaters in these days of dear coal; and the day consumption of gas was up 47·4 per cent. Thus the net effect was that, in spite of less gas being required at night, the consumption was up 26 per cent. Two members suggested that a better pressure of gas for cooking was very desirable during the day.

COKE FOR BOILER FURNACES.

The Engineering Correspondent of the "Yorkshire Post" in his last budget of "Engineering Notes" reproduced some useful figures derived from an experiment in the substitution of coke for coal in a boiler-furnace, as given in the report recently submitted to the Deptford Borough Council—mentioned in the "JOURNAL" for May 23, p. 414. The figures were obtained in the course of a four-weeks' trial with a forced-draught apparatus recommended by the London Coke Committee, and fitted by the South Metropolitan Gas Company to one of the boilers supplying the municipal baths. The figures are as follows:

The price of coal is . . . . . 39s. 6d. per ton.
The price of coke is. . . . . 27s. 1d. ,,

Coke consumed per week:

	Tons	Cwt.		£	s.	d.
First week	21	18	..	29	13	1½
Second week	20	6	..	27	9	9½
Third week	20	6	..	27	9	9½
Fourth week	19	9	..	26	6	9½
	81	19	..	£110	19	6

	Tons	Cwt.		£	s.	d.
Average of the quantity of coal consumed in the corresponding period for the three previous years	67	0	..	132	6	6
Coke consumed in the four weeks' trial	81	19	..	110	19	6
Saving in four weeks. .				21	7	0
Average saving per week .				5	6	9

The only charges to be set off against this saving were those entailed by the extra work thrown upon the stokers, and by the cost of the apparatus. With the coke fuel there was a greater quantity of fuel to handle, a greater bulk of clinker and ashes to be carried out of the boiler-house, more frequent cleaning to be done to the furnaces, and more constant attention to be given to the fire to effect economy. In consideration of this extra work, and in order to encourage the men to continue their interest in keeping-down the fuel consumption, the Council have arranged to pay a bonus of 3s. per week to the stokers so long as the cost of the fuel consumed under the new arrangement shows an economy saving of £4 per week, taking the year round. The forced-draught apparatus was installed on the understanding that if the test resulted in effecting the full economy claimed for it, the Council would purchase the apparatus at a cost of £12 12s.; and this purchase has now been completed. The coal against which coke had to compete in the comparative test was one of the finest grades of coal

The Evolution of the Gas Cooker.

"Economic" Cooker with Hotplate raised.

Remarkable increase in efficiency without sacrifice of ease in manipulation. Laboratory and domestic tests extending over two years prove

The "Economic" Gas Cooker

to be a successful scientific attempt to improve thermal efficiencies.

Descriptive booklet should be in the hands of all Gas Undertakings by now.

THE RICHMOND GAS STOVE & METER CO., Ltd.,
Academy Street, Warrington. 132, Queen Victoria Street, E.C.

obtainable—having only 3 per cent. of ash, and a calorific value of 15,000 B.Th.U. per pound. It is in every way desirable, our contemporary remarks, that steam users should do much more than has been done up to the present in substituting coke fuel for coal; and the Deptford experience, which is by no means unique, should stimulate interest and experiment in other quarters.

TRIBUNALS AND EXEMPTION APPLICATIONS.

The Pudsey Gas Company appealed for their Chief Clerk, who also claimed on personal grounds. Mr. John Wilkinson (the Secretary and Manager of the Company) said the applicant was in a certified occupation, and held that all clerks in gas-works were exempt. It was, he said, undesirable that women clerks should be introduced into gas-works. On the Gas Company's appeal, it was mentioned that they had appealed for him in April, when the application was refused; and the day's records were ordered to be so marked. On the personal appeal, however, he was granted conditional exemption.

At the last sitting of the Tendring Hundred (Essex) Tribunal, the local Gas and Water Company applied for exemption for a cashier and ledger clerk, two engine-drivers, and a mainlayer and turncock. The Manager said all the men were indispensable in their occupations, all having technical knowledge. Conditional exemption was allowed to the engine-drivers and turncock, and the tribunal postponed their decision in the case of the clerk. Mr. Collinge represented the Secretary of the Company in his claim for exemption. Mr. Collinge said that the man was Secretary to two other gas companies, and of a provident society. He also held numerous agencies for insurance companies, and it was impossible to replace him. Conditional exemption was allowed.

At a recent sitting of the Southport Tribunal, the Manager of the Southport Water Board (Mr. A. Watchorn), asked for exemption of two clerks—both 39 years old and married—on the ground of national interests and certified occupation. It was stated that all their other clerks competent to carry out the work were serving in His Majesty's Forces, and female clerks would be quite useless, as the duties required considerable training and experience. The places of those who had joined were filled by females, who were "very inefficient substitutes." Both the men in question had been in the service of the Board for 23 years. They could not get women to effectively take the places of those who had gone, Mr. Watchorn remarked. His experience was that it required "rather more than two women to do one clerk's work." Conditional exemption was given to one of the men, and temporary exemption to the other until Sept. 1.

The Wharfedale Tribunal granted conditional exemption to a plumber and sanitary engineer who was also Water Manager at Menston, and who worked from early morning to late at night on repairs.

NOTES FROM SCOTLAND.

Glasgow Gas Coal Contracts.—The following statement appeared in the "Yorkshire Post" on Saturday: The Glasgow Corporation require 900,000 tons of coal for the gas-works during the ensuing year. The time for the lodging of tenders expired yesterday morning; and at a meeting of the Sub-Committee on Contracts, it was reported that only three offers had been received, representing a total quantity of about 25,000 tons. In normal times, about 130 offers are received. Our Glasgow correspondent says it is alleged that the paucity of offers is due to the question of prices. According to the Price of Coal Limitation Act, the contract price must not exceed 4s. above the price which was current at the corresponding period during the year from July 1, 1913, to June 30, 1914. It is stated that if contracts were fixed this month they would, by being regulated by the prices current in June, 1914, be at a much lower level than they would be if entered into next month, when prices will compare with those in July, 1913, when values were high. The Sub-Committee decided to place the information in their possession before the proper authorities, and meantime remitted the whole matter to the Sub-Committee of the Corporation dealing with the question of coal supply.

Cheaper Gas for Arbroath.—The report of the past year's working of the Arbroath Corporation Gas Department submitted at a meeting of the Town Commissioners last week was of so favourable a nature that it was decided to lower the price of gas by 2½d. per 1000 cubic feet—thus reducing the price to ordinary consumers to 2s. 8½d. per 1000 cubic feet. It was found that a saving of £2700 had been effected as a result of the working of the vertical retorts, compared with the horizontal retorts previously in use. More than 1000 cubic feet extra gas had been obtained per ton of coal carbonized than with the old retorts; and increased yields of sulphate of ammonia and tar had also been secured. Coal had cost 5s. 7d. per ton more than during the previous year—entailing an additional expenditure of £3000 odd.

Carnoustie Gas Supply.—According to Bailie Nicoll, the Convener of the Carnoustie Town Council Gas Committee, the past year's working of the gas estate was very satisfactory. At the commencement of the year the increase made in the price of gas—viz., 6d. per 1000 cubic feet—was, he said, among the lowest in the kingdom, and they took the risk of making the works pay. They had almost managed, notwithstanding that the rise in the cost of coal alone was equal to 5d. extra per 1000 cubic feet of gas. In preparing the estimates for next year they proposed taking the same risk, and keep the gas at the same price—viz., 4s. 2d. per 1000 cubic feet for ordinary meters, and 4s. 7d. for slot meters. After some discussion, the minutes were adopted.

Fatality to a Glasgow Gas Worker.—Last Saturday week, James Lavin, who was employed by the Glasgow Corporation Gas-Mains Department, was overcome by gas fumes and rendered unconscious while repairing a gas-pipe in Mathieson Road. He was conveyed to the Royal Infirmary, and died two hours after admission. Lavin was 43 years of age.

ARDEN HILL'S

"ZENITH" COMBINED GAS HEATER AND STORAGE TANK,

With Automatic Gas Valve (Thermostat).

Made in three sizes:
10 Gallons,
20 "
40 "

Enables Gas Cooker to be regularly used in winter and summer alike.
Eliminates raw coal from domestic use.

Secures a steady gas consumption. Reduces gas-works' running expenses by increasing gas output.
Spreads capital and standing charges over wider area.

UNEQUALLED FOR PROVIDING CONSTANT SUPPLIES OF HOT WATER FOR IMMEDIATE USE AT MINIMUM COST.

On hire with many leading Gas Companies.

Illustrated List on application.

ARDEN HILL & CO., Acme Works, BIRMINGHAM.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *June* 12.

The London tar products market still pursues its steady but uninteresting course. Naphthalene remains at a very high value; while makers still quote pitch for export at 19s. to 19s. 6d. net per ton, creosote at 4d. to 4¼d. per gallon in bulk, and solvent naphtha at 2s. to 2s. 1d. net in bulk—all at makers' works.

The position of sulphate of ammonia is improving, but makers' prices are ridiculously low as compared with the market value of nitrate of soda.

Tar Products in the Provinces.

June 12.

There is practically nothing fresh to report concerning the market for tar products. Pitch remains in the same position, and there is very little business doing. Creosote is quiet. There seems more solvent naphtha offering. The price of heavy naphtha keeps steady.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¼d. to 2½d. Heavy oils, in bulk, 3¼d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *June* 10.

There has been rather more demand for this material during the past week, and in some instances slightly higher prices have been paid for near delivery. Direct buyers have, however, not been much in evidence, and the bulk of the inquiry has come from dealers. The prompt values are now £16 17s. 6d. to £16 18s. 9d. per ton f.o.b. Hull, £17 to £17 1s. 3d. f.o.b. Liverpool, and £17 2s. 6d. to £17 3s. 9d. f.o.b. Leith. No new first-hand business has been reported in the forward position, and the quotations, f.o.b. good ports, are £17 5s. per ton for July/September, and £17 10s. for October/December delivery.

Nitrate of Soda.

The tone of this market is easier on spot, and holders will now accept 18s. 4½d. per cwt. for ordinary quality, and 19s. 1½d. for refined.

Sulphate of Ammonia.

From another source it is stated that for this article to-day's quotations are as follows: Outside London makes, £15 12s. 6d. to £15 15s.; Hull, £16 10s. to £16 12s. 6d.; Liverpool, £16 12s. 6d. to £16 15s.; Leith, £16 15s. to £16 17s. 6d.; Middlesbrough, £16 12s. 6d. to £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.—The coal trade is steady. The lack of ready steamers has, however, rather limited prompt business; and where early shipment can be guaranteed, prices have shown a little ease for some kinds of fuel. The freight market, however, is firm, and to some ports the rates are higher. In the steam coal trade, the demand is full. The price of best Northumbrian steams is from 61s. to 63s. per ton f.o.b., except to France, where the lower regulation prices are beginning to come into force. Second-class steams are about 56s. per ton; and steam smalls are firm at 32s. to 34s. per ton f.o.b. The demand for forward supplies is brisk, and the output is readily taken up—this being one of the strongest periods of the shipping season. In the gas coal trade, business is active, and prices are well maintained. Best Durham gas coals are quoted at 37s. per ton f.o.b.; second-class gas coals are near 36s. per ton; and "Wear Specials" are from 37s. 6d. to 38s. 6d. per ton f.o.b. The output of coal is fair under the circumstances; but contracts and quantities needed pressingly make the amount of coal free for sale limited, and thus, with a strong demand, keep up high prices. The period of low consumption of gas coal does not seem to have reduced the demand, as users are trying to add to their stocks. Contracts are only slowly made at present, though the lower freights to France under the "limitation" arrangement lessens the cost of coal at some of the ports; but it is possible that there may be a diversion of tonnage to uncontrolled trades. Good gas coke is quoted from 29s. to 30s. per ton f.o.b. in the Tyne.

Price Increases at Hereford.—The Hereford Town Council have, on the recommendation of the Gas Committee, decided to increase the price of gas from 2s. 9d. to 3s. 3d. per 1000 cubic feet, less the usual discount of 3d. The charges for gas supplied through prepayment meters will be on the same basis.

Blackpool Trading Concerns.—Blackpool's trading concerns for the past year show a net profit of £31,215 (the equivalent to a 1s. 3d. rate), which the Finance Committee have apportioned in the following manner: Gas, £5000 to general district fund, £1000 to the borough fund, £4368 to reserve, £1000 to the provision of a working balance, and £550 to the Art Gallery for purchase of pictures—£11,918 2s. 6d. in all. Electric light, £2000 to reserve and £478 working balance. Tramways, £5000 to the borough fund, £8000 to permanent way renewal fund, and £3275 to reserve.

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Lincoln Municipal Undertaking.

The accounts of the Corporation gas undertaking, presented at a meeting of the Lincoln City Council last Tuesday, showed that during the last financial year the net profit was £5569; being £676 more than in the preceding twelve months. The price of gas was twice increased, and was now 2s. 6d. per 1000 cubic feet. Alderman T. Wallis observed that the results had come out very satisfactorily in a very difficult year. There was a much larger profit reported from the waterworks; the income for the year ending March 31 having been £33,629, and the working expenses £10,752, leaving a balance to transfer to the net revenue account of £22,877, which was just in excess of the amount in the previous year. The charge for water for domestic purposes remains the same—2s. 4d. in the pound in the city, and 3s. 4d. in outside districts. The total capital expenditure on the undertaking is £426,847, and the net outstanding debt £285,071. The demand for electricity for power purposes was reported to have been larger. The revenue for the year had been £17,448—an increase of £2428. The working expenses, £10,517, showed an increase of £3327. The gross profit had been £6904, a decrease of £899; and there had been a net profit of £1690, the tramways having yielded a net profit of £388.

Tees Valley Water Board.—At a meeting of the Tees Valley Water Board last week, the Manager (Mr. Hugh Wilson) reported that the consumption for manufacturing purposes showed a very satisfactory increase for the quarter, while the domestic consumption had decreased. It was ordered that out of revenue the following payments should be made: Stockton Corporation, £10,000; Middesbrough Corporation, £12,000; and Thornaby Corporation, £2000. A memorandum prepared by the Board regarding the supply for 1915 shows the weekly average consumption was 102,731,000 gallons, a decrease of 244,000 gallons per week. The gross receipts for the year amounted to £127,860, as against £135,047 in the previous year; and there was a net loss of 0·5395d. on every 1000 gallons sold.

Water for Steam Motor-Waggons.—In several towns an arrangement is being tried which should overcome the difficulty of obtaining a supply of water *en route*, which has at times been a trouble in connection with steam-vehicles. The device is a water-delivery pillar, which can only be worked by the introduction of a standard disc. It applies the principle of the "penny-in-the-slot" machine to the delivery of water. The discs are issued by the water authority, either through the Motor Users' Association or direct to individual users, at a fixed charge, which in the case of Rochdale is 3d. per disc. At present there is no measure of the quantity of water supplied for the disc; the flow being maintained so long as the lever which operates the mechanism is held down. With one kind of disc, therefore, a lorry of any capacity can be filled. It has been suggested that an improved type of the machine might be introduced which would put either a time-limit or a limit of quantity upon the supply for each disc inserted.

Diminished Coal Stocks at Tipton.—In a report presented to the Tipton Gas Committee, the Engineer (Mr. W. Prince) states that the coal stock is fast diminishing, despite all efforts. While there are many much-needed improvements and repairs to the gas-works plant he proposed that, with the exception of an enlargement of a leading main from the holders, including a new governor (the estimated cost being approximately £500), all work should be left over until times are normal. He recommends that the public lamps should not be lit during the summer.

Staffordshire Potteries Water Company.—Moving the adoption of the report at the annual meeting of the Company last week, the Chairman (Mr. James Maddock) said there was an increase in revenue of £890, which the Directors considered very gratifying. The receipts for the year were £67,635, with a profit of £30,759—making, with the balance brought forward, a sum available for dividend of £34,411. Dividends were declared of 9 per cent. on the consolidated ordinary stock, and of 7 per cent. on the consolidated new ordinary stock. There will be a balance of £3734 to be carried forward.

Carburetted Water-Gas Tar for Roads.—Writing to the "Daily Chronicle," Mr. H. R. Gawen Gogay gives the following extract from a letter he has received from Mr. Ernest J. Elford, the Borough Engineer of Southend-on-Sea, which he thinks may interest local authorities in London and elsewhere: "I approached the Gas Company with the view to experimenting with carburetted water-gas tar, which has no great commercial value. So far, the experiment appears to have turned out very well, and I hope will enable us to keep down the dust and hold the roads together, at a small cost, at any rate until normal conditions return." Mr. Gogay adds that he can bear witness that the solution used on the roadway has been a perfect success; and he concludes with the question, Why does not London follow suit?

Public Lighting on Moonlight Nights Question at Lambeth.—The Lighting Committee of the Lambeth Borough Council have reported that they have considered a question raised at a previous Council meeting as to whether the Committee would approach the gas companies to ascertain if some arrangement could be made for the non-lighting, or more restricted lighting, of street-lamps on moonlight nights—thus effecting a saving of the rates and leading to further economy in coal consumption. The Committee were of opinion that the proposal was hardly practicable, as they would have to determine which nights could be defined as "moonlight nights"—*i.e.*, how many nights before and after a full moon—and for what parts of such nights; while yet another difficulty was that even sometimes during a full moon on very cloudy and overcast nights the light from the moon would be insufficient to enable the lighting of the street-lamps to be dispensed with. The Committee ascertained that in a provincial town the practice had been tried; but the experiment was so distasteful to the residents, and especially to the trading portion of the community, that it was abandoned after eight days. The Committee recommended that no action should be taken in the matter; and the Council agreed.

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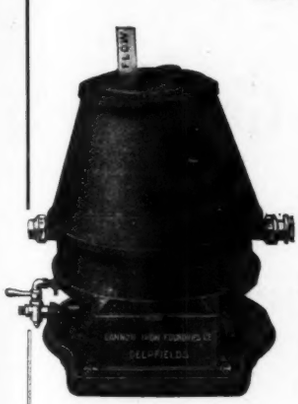

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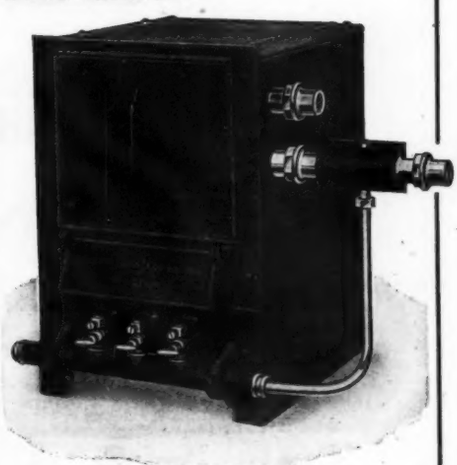

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Price of Gas at Bangor.—The Bangor City Council, at a meeting last week, confirmed the recommendation of the Lighting Committee to increase the prices of gas as follows: Ordinary lighting consumers, 6d. per 1000 cubic feet; ordinary slot-meter consumers, 5d.; ordinary heating, cooking, and power consumers, 6d.; and slot installations, 5½d.; also that the sliding-scale for consumers of 50,000 cubic feet and upwards be increased 6d. per 1000 feet for each of the present scheduled prices.

Birkenhead New Water Scheme.—At last week's meeting of the Birkenhead Town Council, when mentioning the new water supply scheme and the steps taken to complete it, the Chairman of the Water Committee (Alderman J. H. Bloor) stated that the application of the Council for sanction to borrow further moneys to proceed with the undertaking during the present financial year was still under consideration by the Treasury, who had sent a communication dealing with the matter, which was at present receiving the consideration of a Special Sub-Committee of the Finance and Water Committees.

Birkenhead and its Economy Committee's Report.—At a meeting last Wednesday of the Birkenhead Town Council, the final report of the Special Committee appointed to inquire into Corporation finance and management was considered. Mr. T. L. Dodds, the Chairman of the Committee, in moving its adoption, referred to the management of Corporation departments. As to the gas undertaking, he said he was quite satisfied with the contents of the report made by Mr. W. Doig Gibb, and its genuine honesty. Those who had read the report might be sure that they had got to the bottom of the gas undertaking. There was nothing reprehensible in connection with it.

Birmingham Water Supply.—In moving the adoption of the annual report and accounts of the Birmingham Corporation Water Committee [*ante*, p. 518] at the Town Council meeting last Tuesday, the Chairman (Alderman Lloyd) said the water rates and charges showed an increase last year of £65,000, of which £52,000 odd was due to revision and revaluation, and £12,800 to actual growth. The gross profit was £265,000, against £217,000 the previous year—an increase of £48,000. In view of the increase in water-rates, the result was disappointing; and the Council might wish to know the cause. The simplest way to put it was as follows: The deficiency on March 31, 1915, was £88,000; the water-rates had increased by £65,000; therefore the deficiency this last year should be only £23,000. Why, he asked, was it £62,000, instead of £23,000—£39,000 more than it should be? The causes were the working expenses, interest, and redemption of debt. Working expenses were £16,860 heavier, interest had increased by £11,000, and these items, with £10,900 for redemption of debt, made a total of £38,883. Referring to the postponed construction of the third pipe-line from Wales, Alderman Lloyd said this was a serious matter, and might cause a curtailment of the supply to the city during the next few years. Meanwhile, the Council might rely on the Committee doing their utmost to obtain the maximum quantity from the existing sources.

Irish Gas Undertakings.—At a meeting of the Lisburn Urban Council, the gas-works revenue account for the past year was presented and showed a net profit of £842, which was considered very satisfactory. Mr. Pelan impressed on the Council the necessity of obtaining power from the Local Government Board to increase the price of gas from 4s. per 1000 cubic feet; and a deputation was appointed to wait on the Board in regard to the matter. The Coleraine Urban Council have advanced the price of gas to 4s. 2d. per 1000 cubic feet for power purposes and 4s. 7d. for lighting.

At a meeting last week of the Brimington Parish Council, it was pointed out that, in reply to the Council's letter to the Whittington Gas Company, asking for an allowance on the cost of street lighting for the current half year, through the gas being only partially used, the Company agreed to grant an allowance of £36 1s. The charge in the usual way would have been £83 10s. 6d.

The Bradford Water Committee visited the Nidd Valley water-works of the Corporation last week, to consider on the spot the policy to be adopted with regard to the construction of the proposed new Scar House reservoir, for which the Corporation obtained powers in their last Act. The party included the Lord Mayor, the Chairman of the Finance Committee, the City Treasurer, and the Water-Works Engineer (Mr. James Watson).

The Directors of the European Gas Company, Limited, have decided to recommend, subject to audit, the payment of a dividend of 5s. per share free of income-tax, on Aug. 1 next (as compared with 10s. paid at the same period last year), taking from the reserve of undivided profits the sum necessary to make up the dividend, which, with the interim dividend paid on Feb. 1, will represent a total dividend of 7½ per cent. free of income-tax for the past financial year.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

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STOCK MARKET REPORT.

THE Stock Exchange has had another extraordinary week; the great upward move in almost all markets which characterized its predecessor being stronger than ever. The key to it all lies in the 2s. super-tax on dollar securities, the threat of which has brought to the Treasury enormous quantities of the desired stocks—so much that the investment of the proceeds is a matter of great difficulty, and the excess of demand over supply has sent prices up like balloons soaring in the air. It makes steady-going folk a little anxious lest some "accidents" may happen. Apart from Treasury Bills and Exchequer Bonds, all gilt-edged things were booming. War Loan at 96⅜ and Consols at 61¼ are striking figures. In Home Rails, both ordinary and prior charges are snapped up when there is a chance. Even American came in for some crumbs. In the Foreign Market there was a strong demand. French loan rose steadily to 86½, Russians were in great request, and Brazilian and Japanese improved on their already high figures. Argentines recovered somewhat, and South African closed firm. In the Miscellaneous Market, rubber shares were stronger, and oil was in good demand. Warlike industrials were very good, and shipping concerns—after a temporary check from realizations—forged ahead again. Business in the Gas Market was about on the average of the last few weeks so far as the number of bargains is concerned, and the general tone was very satisfactory. Realizations in Imperial Continental after the recent big advances knocked a point off the figures; but otherwise all transactions throughout the list showed a step upward. European will pay a final dividend of 5s., per share, tax free, making 15s. for the year. In the Money Market, rates showed little change. Among general topics, the withdrawal by the Treasury of the under £300 a year limit for holders of War Savings Certificates comes better late than never. Trade returns for May show a gratifying increase in export values. The profits revealed in the accounts of a large firm of coal merchants are not pleasant reading for the gas industry.

Bargains done for cash during the week were as follows: On Monday, European 13½, Gas Light ordinary 75, 75¼, 75¾, 76, ditto debenture 60¼, Oriental 105, Primitiva preference 3 1/16. On Tuesday, Gas Light ordinary 75⅝, 76, ditto debenture 60¼, 60⅜, 60½, Imperial Continental 77¾, 78½, Monte Video 8½, South Metropolitan 80½, 80⅝. On Wednesday, Gas Light ordinary 75¼, ditto maximum 60, ditto preference 75, ditto debenture 60, Primitiva preference 3⅜, 3 7/16, South Metropolitan 80½. On Thursday, British 35 7/16, Gas Light Ordinary 75¼, 75½, 75¾, 76, ditto maximum 60½, Primitiva 39s. 9d., ditto preference 3⅜, South Metropolitan 80. On Friday, Commercial 4 per cent. 74½, Gas Light ordinary 75⅜, ditto maximum 60, 60½, ditto preference, 74¾, 75½, ditto debenture 60⅝, Imperial Continental 77, 78½, South Metropolitan, 80, 80½, 80⅝, 80¾, South Suburban, 80. On Saturday, British 35, ditto debenture 69, Commercial 4 per cent. 73¾, ditto 3½ per cent. 70, ditto debenture 57, Gas Light ordinary 75½, 76½, Imperial Continental 76½, 77½, South Metropolitan 80¼, 81.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,858	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	8 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5½—6¾	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water: 10 p.c.	29—30	5 6 8	..
333,110	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	Bournemouth Gas and Water: 4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford A Consold.	261—266	5 5 8	..
734,920	,,	,,	†11	55/-	Do. B New	204—209	5 5 8	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
317,380	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—213	5 8 4	..
344,900	,,	,,	8	7½	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	35—35 7/16
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	69
945,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	73½—74½
660,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	70
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	57
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 8	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,370	Stk.	—	6	5½	Derby Con. Stk.	128—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	18⅛
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke: 4 p.c. Ord.	98—102	4 15 6	75—76½
2,600,000	,,	,,	3½	3½	Gas Light and Coke: 3½ p.c. max.	76—79	4 8 7	60—60⅛
4,062,295	,,	,,	4	4	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	4 0 10	74½—75⅛
4,674,850	,,	June 11	3	3	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	4 0 6	60—60½
130,000	,,	,,	10	10	Gas Light and Coke: 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16⅝	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7½	7½	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅝	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	76½—78½
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. {A / n}	211—213 / 146—148	4 13 11 / 4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 18 4	8½
1,575,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8/2	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	105
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
349,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	39/9
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅝—5	5 0 0	3⅞—3 7/8
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo: 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo: 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	293—294	4 9 8	..
209,984	,,	,,	10	10	Do. B	292—294	4 9 8	..
523,500	,,	,,	10	10	Do. C	290—292	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	80—81
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
224,890	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
962,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	80
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
647,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District: A 5 p.c.	185—188	5 8 8	..
782,275	,,	,,	6	6	Tottenham District: B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	Tottenham District: 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	103½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	5	5	5 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

RESIDENT SALESMAN. No. 6185.
GAS FITTERS. Weston-super-Mare.
BLACKSMITH AND WORKS FITTER. No. 6186.
STOKERS. King's Lynn Gas-Works.

Appointments, &c., Wanted.

COLLECTOR. No. 6187.
AGENCY. G. Margueritte, Paris.

TENDERS FOR

Coal.

BAKEWELL DISTRICT COUNCIL. Tenders by June 30.
CLITHEROE GAS DEPARTMENT. Tenders by June 24.
HAWORTH DISTRICT COUNCIL. Tenders by June 24.

Gas Booster.

MALVERN GAS DEPARTMENT. Tenders by June 27.

Tar and Liquor.

BAKEWELL DISTRICT COUNCIL. Tenders by June 30.
GAINSBOROUGH GAS DEPARTMENT. Tenders by June 17.
READING GAS COMPANY. Tenders by June 19.

BOOKS AND LEAFLETS

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS. Eighth Edition. *18s. net.*

COMPETITION POINTS FOR GAS SALESMEN.—By ARTHUR F. BEZANT. *Price 3s. 6d. net.*

A COMPLETE ACCOUNT OF THE GRANTON GAS-WORKS OF THE EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS, their Design, Construction, and Equipment, with Illustrations, Plates, and Details of Costs.—By W. R. HERRING, M.Inst.C.E., &c. 300 Pages and 28 large folding Plates. *Price 16s. net cash.*

PRACTICAL ADVICE ON GAS-FITTING.—By R. HALKETT. *Price 2s. 6d.*

VALUATION OF GAS, ELECTRICITY, AND WATER-WORKS FOR ASSESSMENT PURPOSES.—Second Edition. By THOMAS NEWBIGGING, M.Inst.C.E., and WILLIAM NEWBIGGING, Assoc.M.Inst.C.E. *Price 5s.*

GAS COMPANIES' BOOK-KEEPING. — Second Edition.—By JOHN HENRY BREARLEY and BENJAMIN TAYLOR. *Price, cloth 12s. 6d.; morocco 18s.*

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS AND WATER UNDERTAKINGS, 1891-1901 (the Volume for 1879-1890 is still on Sale).—By E. H. STEVENSON and E. K. BURSTAL, MM.Inst.C.E. *Price 21s.*

GAS CHEMISTS' SUMMARY, 1914. By A. V. HENDRICKSON. Price 3s. 6d.

CLAUSES AND PRECEDENTS IN ELECTRICITY, GAS, AND WATER LEGISLATION. By JACQUES ABADY, Barrister-at-Law. *Price 15s. net.*

GASHOLDER AND TANK AT THE SUTTON GAS-WORKS (one million cubic feet capacity).—By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. *Price 10s. 6d.*

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GASHOLDERS WITH OR WITHOUT GUIDE-FRAMING.—A Discussion between E. LLOYD PEASE and F. SOUTHWELL CRIPPS. *Price 1s.*

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Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SPENCER'S Patent Inclined HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, May 16, p. 361.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

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SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
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We Guarantee promptness with efficiency for Repairs.
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HUMPHREY (UPRIGHT TYPE) GAS-LAMPS.

WE Notice there are still a considerable number of our ORIGINAL GAS ARC LAMPS in use throughout the Country, and desire to make known that we are now booking instructions for renewal parts and accessories, also GLASSWARE for each type of lamp, for forward delivery. Sole Representatives for Humphrey Gas Goods, THE GENERAL GAS LIGHT CO., 58 64, Leonard Street, LONDON, E.C.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the Enrichment of Gas.
Manufactured and Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agents, F. J. NICOL & CO., Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

G. MARGUERITTE, 20, Rue de Grammont, Paris, Representative for Gas and Electricity Works, is desirous of taking up AGENCY for English Firms doing business with these Industries for the Sale of Coal, Plant, Chemical Products, Glassware, &c.

SITUATION sought as Collector by Rejected Derby Recruit. Some knowledge of Book-keeping. Long periods in previous Positions.
Address, No. 6187, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

AN Old-Established American Company, Manufacturing Gas-Burners and kindred Lighting Goods, and now Shipping same to several large British Firms, desires an Experienced RESIDENT SALESMAN in Great Britain familiar with that trade to sell on a Commission Basis. No objection to his handling other Lines of Goods for same trade, not conflicting. References exchanged.
Apply, by letter, to No. 6185, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

WANTED—Leading Stoker, used to Shovel Charging, Engine, and Boiler. Also SECOND STOKER. Wages 6s. 3d. and 6s. per Shift (Twelve Hours) respectively, with Bonus, and 5s. Monthly War allowance. Week Holiday Annually. Grant towards Removal Expenses.
Apply, stating Age, Height, Experience, where at present or last Employed, and whether Married or Single, to the ENGINEER, Gas-Works, KING'S LYNN.

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WANTED—Gas-Fitters. Must be Ineligible.
Apply, with full Particulars, to the SECRETARY, Gas Company, WESTON-SUPER-MARE.

WANTED—A Good Reliable BlackSMITH and WORKS FITTER for a Gas-Works near London. Must be well up in Smithing and accustomed to General Repairs on a Gas-Works. Permanency to a Reliable Man. Good Wages paid.
Apply, by letter, stating Age, Experience, and Wages required, with *copy* of Reference, to No. 6186, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

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One Flat-end Boiler TANK,			7 ft. diam. by 20 ft. long
One	"	"	6 ft. 6 in. " " 22 ft. "
One	"	"	6 ft. " " 28 ft. "
One	"	"	6 ft. " " 21 ft. "
One	"	"	5 ft. 6 in. " " 15 ft. "
One	"	"	5 ft. 6 in. " " 27 ft. "

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MALVERN URBAN DISTRICT COUNCIL.

GAS BOOSTING PLANT.

THE Gas Committee of the above Council invite TENDERS for the Sppply and Erection of a GAS BOOSTER.
Specification and full Particulars to be obtained from the undersigned.
Tenders, addressed to the Chairman of the Council, Council Offices, Malvern, to be Delivered by the 27th of June, 1916.
The lowest or any Tender not necessarily accepted.
S. TROW SMITH,
Engineer and Manager.
Council Offices, Malvern,
June 10, 1916.

READING GAS COMPANY.

TENDERS FOR TAR.

THE Directors of the Reading Gas Company invite TENDERS for the Purchase of their Surplus COAL-GAS TAR and CARBURETTED WATER-GAS TAR for One Year, commencing on the 1st of July next.
Specifications for the Contract will be forwarded on Application to the Engineer and Manager, Mr. Douglas H. Helps, Assoc.M.Inst.C.E.
Under the Conditions of the Contract, an allowance will be made for all water that may be found in the Tar in excess of 5 per cent.
Railway and River Communications direct to the Works.
Tenders, endorsed "Tenders for Tar," and addressed to the undersigned, must be Delivered not later than Monday, the 19th of June.
The Directors do not bind themselves to accept the highest or any Tender.
A. B. STEDMAN,
Secretary.
159, Friar Street, Reading,
May 30, 1916.

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